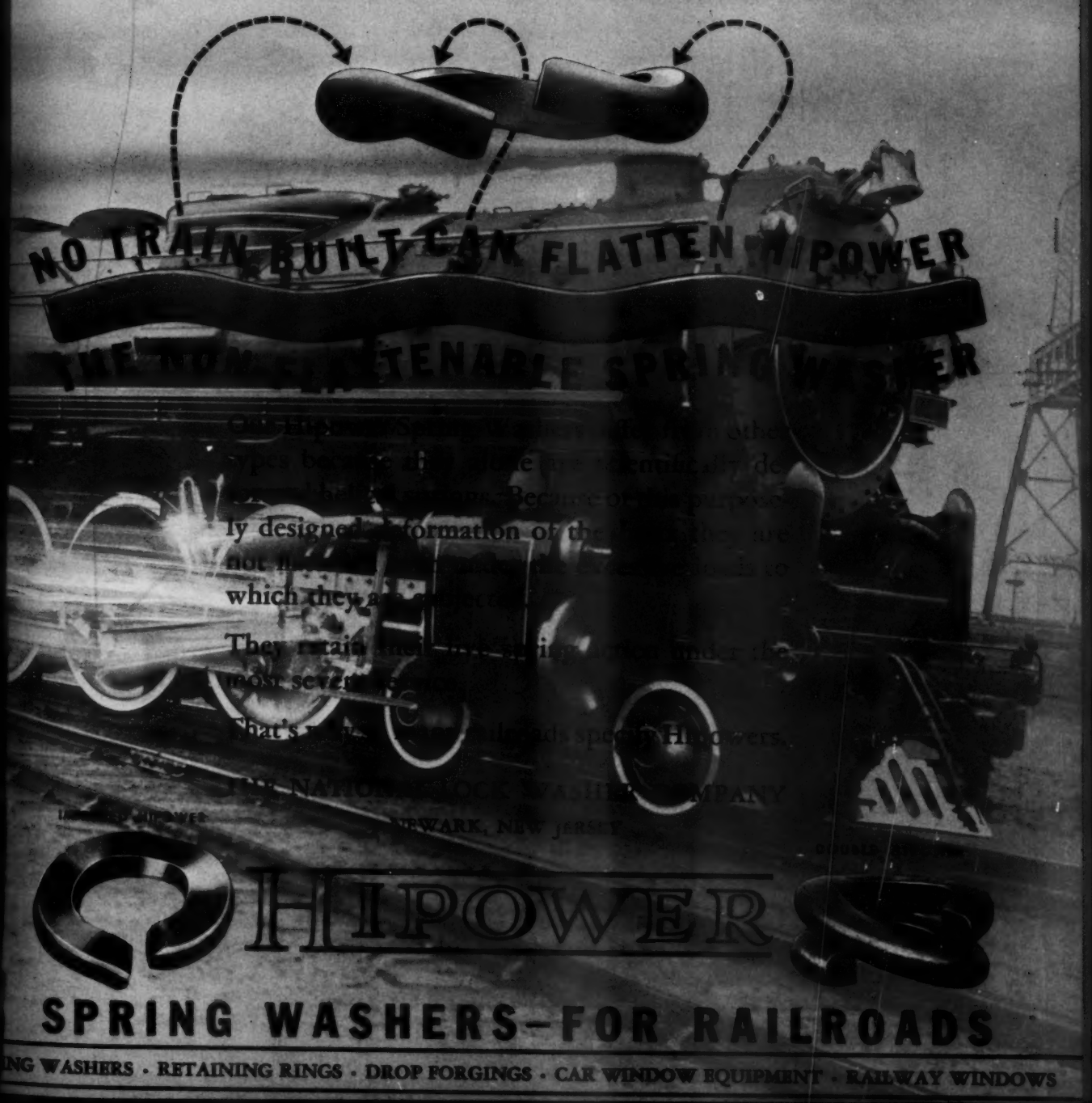
APRIL, 1930

Railway Engineering and Maintenance



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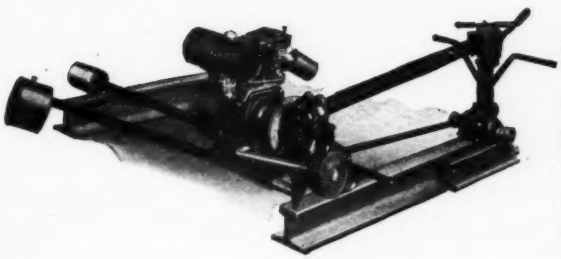

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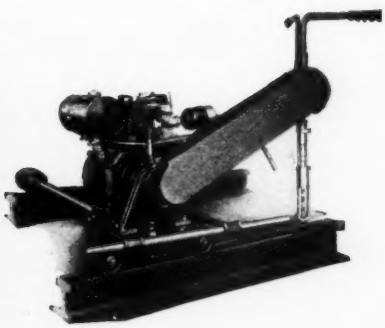

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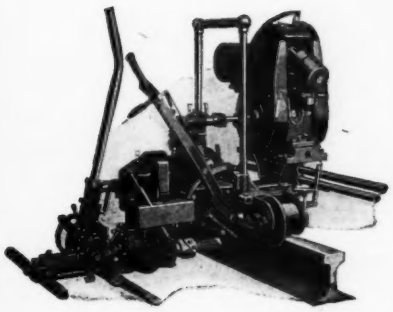

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NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 25 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

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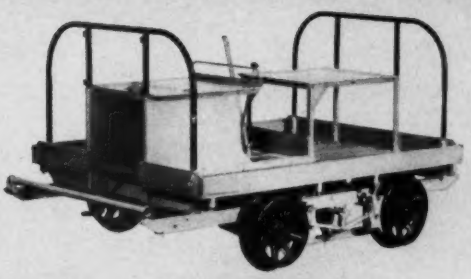
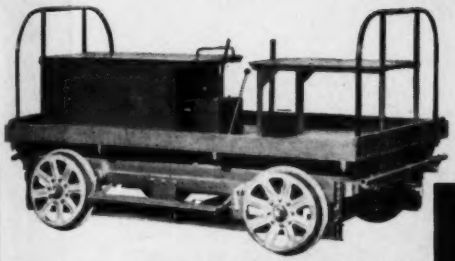


Fairmont A3 Series C. Ideal for towing mowers, extinguisher cars, heavy supplies, and large gangs. The 20 H.P. 4-cylinder engine supplies plenty of smooth power. See bulletin 403.



Fairmont A6 Series C. Its 85 H.P. Ford V8 engine develops sufficient power to tow in one trip, on trailers, all of the men in the largest extra gang. Seats 10 men. Lift weight 610 lbs. Ask for bulletin No. 406.

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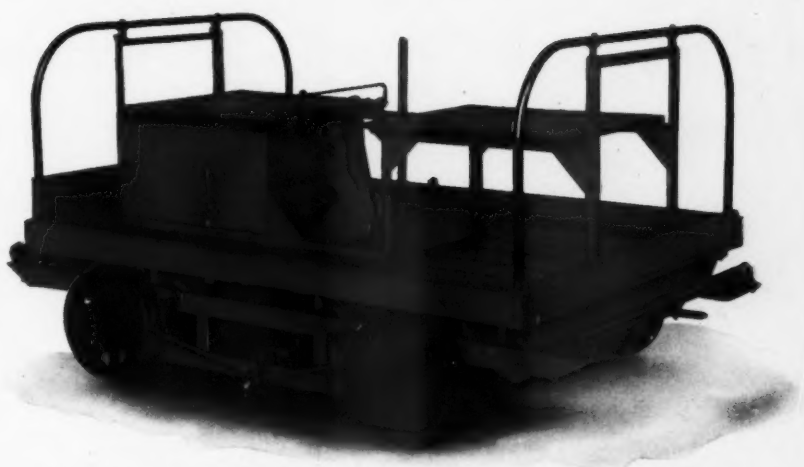

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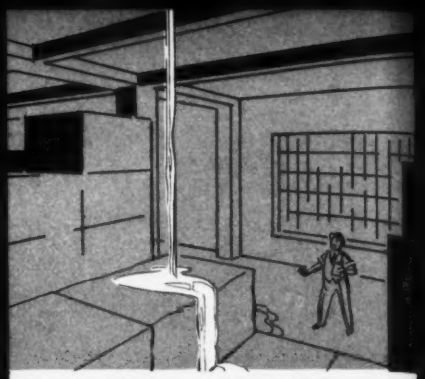
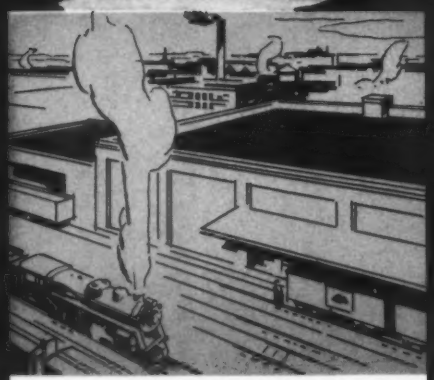
THE ROOFING THAT CUT RAILROAD DAMAGE CLAIMS

"Writing your first roofing specification, eh? And I'll soon be writing my last one. Well, Son, I hope you learn earlier than I did that the best thing for railroad roofs is to specify Koppers Coal Tar Pitch.



"You see, the first roof I specified was on a freight warehouse. I didn't call for coal tar pitch on that one. It developed a leak and the water ran in on a shipment of silk, and we had to pay a big damage claim.



"After that, I decided that the thing that really counts in railroad roofs is whether or not they might leak. You see, a railroad has so many roofs and has them scattered all over the system, and it is almost impossible to make sure that they get any attention.

"I've kept some pretty accurate records of roofs over many years, and have concluded that coal tar pitch roofs are best whenever you have a flat-roofed building. Out on the Northwest Branch there's a coal tar pitch roof I specified that's been on more than 25 years.

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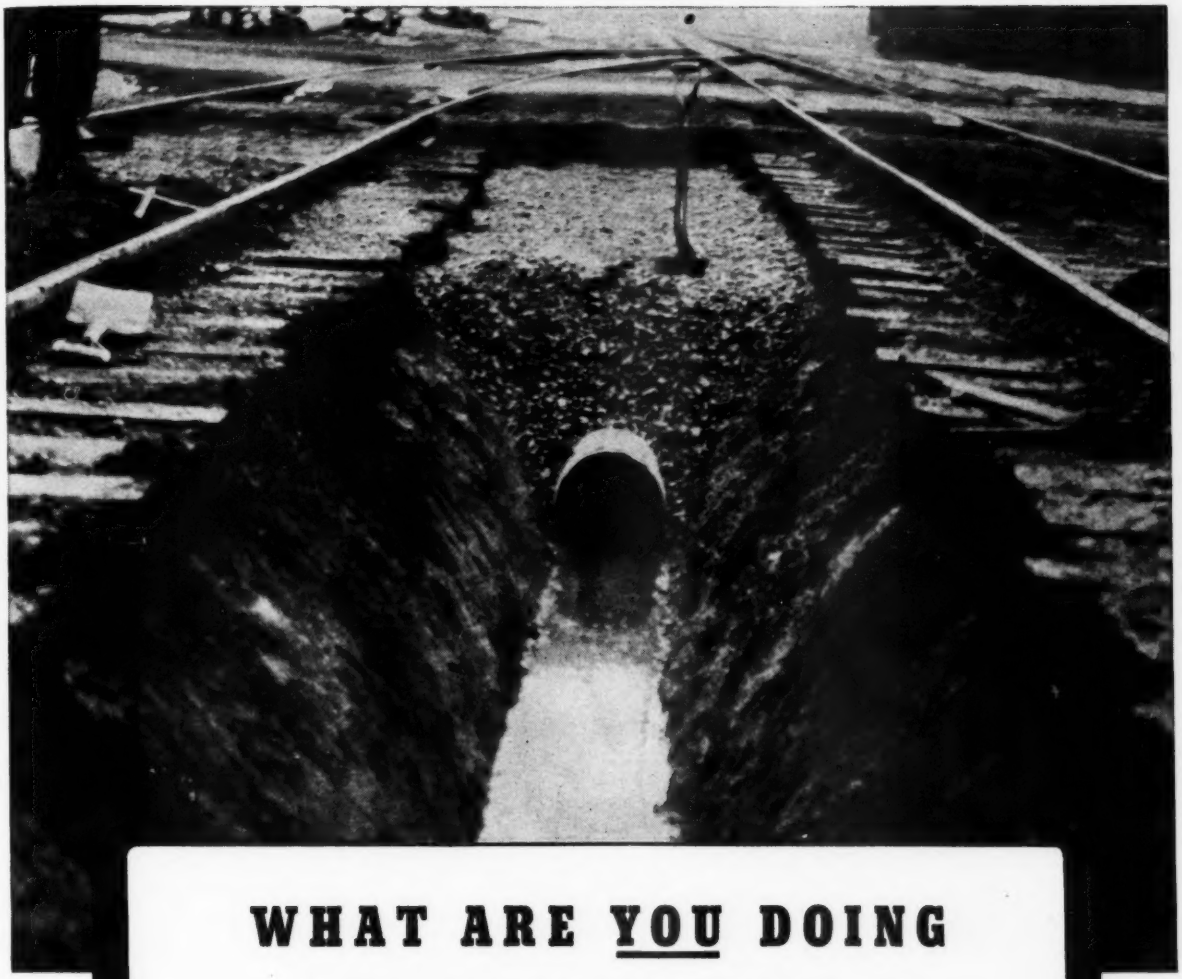
INTERNATIONAL Industrial Power



WHAT ARE YOU DOING ABOUT THE WATER *Under Your Tracks?*

• Railway engineers agree that impounded water is a *dangerous enemy* of good track. Especially when you consider present day loads and the need for maintaining high speed schedules.

Trapped "out of sight" under the tracks, the extent of this harmful ground water often is not realized. And yet in many cases, it is *costing thousands of dollars annually*, in terms of increased track maintenance and expensive "slow orders."

Fortunately, there is a way to eliminate these undesirable conditions *permanently and economically*. It lies through a systematic program of subdrainage with Armco Perforated Iron Pipe. Let us show you the amazing results obtained by leading railroads. Address: Ingot Iron Railway Products Co. (Member of the Armco Culvert Manufacturers Association), Middletown, Ohio; Philadelphia, Dallas, Atlanta, Salt Lake City, Minneapolis, Los Angeles, Denver, St. Louis, Portland, Cleveland, Spokane, Chicago, Richmond, Houston, and Berkeley, California.

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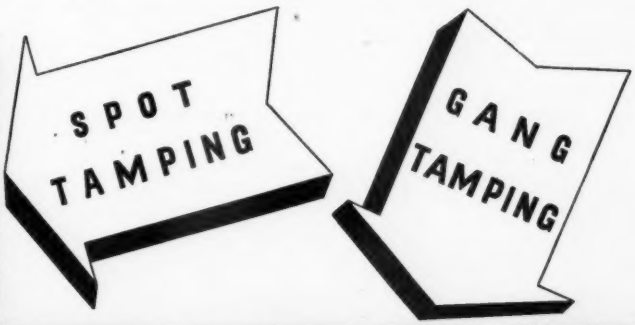

For 31 Railroads

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No. 112 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Conventions and Exhibits

Dear Reader: April 1, 1938

If you attended the exhibit of engineering and maintenance of way materials and equipment at the International Amphitheatre, Chicago, on March 14-17, as I did, I am sure that you were impressed by the marked interest that so many railway men took in the products on display. When it was announced that the exhibit would be held in this newer building, a number of manufacturers exhibited a not unnatural concern regarding their ability to attract railway men to this new location, more than five miles from the convention headquarters and the center of the city. Yet every manufacturer with whom I have since discussed the exhibit has been enthusiastic regarding the large number of railway men who visited the display and regarding the care with which they studied it.

To me this is significant from several standpoints. In the first place it demonstrates that railway men are keenly interested in the materials and devices that manufacturers have perfected for their use and that they will avail themselves of opportunities to study these developments. Furthermore, this interest demonstrated an absence of defeatism on their part over the present outlook and their belief that their return to the market will not be long delayed. In fact, a very sizable volume of orders were either placed or definitely lined up at the show and some equipment on display was sold for shipment direct to user.

Not the least important observation of the exhibit and also of the convention was the widespread evidence of the practical value of the opportunities that these gatherings afford railway men to acquire knowledge regarding materials and methods available to meet the new problems that are now confronting them. In these days when railway and railway supply manufacturers are scrutinizing expenses most closely, you have undoubtedly heard comments, as I have, regarding the costs of conventions and exhibits. Yet I could not escape the conviction that these meetings were worth many times their cost to the alert railway man through the opportunity that they afforded him to gather ideas that will be of aid to him in the solution of today's changing problems with the efficiency that these days demand. And I carried away with me the conviction also that exhibits such as these provide an opportunity for railway supply manufacturers to present their story to a large number of potential customers at a fraction of the cost that would be required to visit these men individually in their widely scattered headquarters.

All in all, it struck me that this convention and exhibit were of great value to railway maintenance officers in meeting their problems of today. And I have been thinking also of the similar value that will accrue to those other men who will attend the Roadmasters and the Bridge and Building conventions this fall.

Yours sincerely,

Elmer T. Howson

ETH:EW Editor

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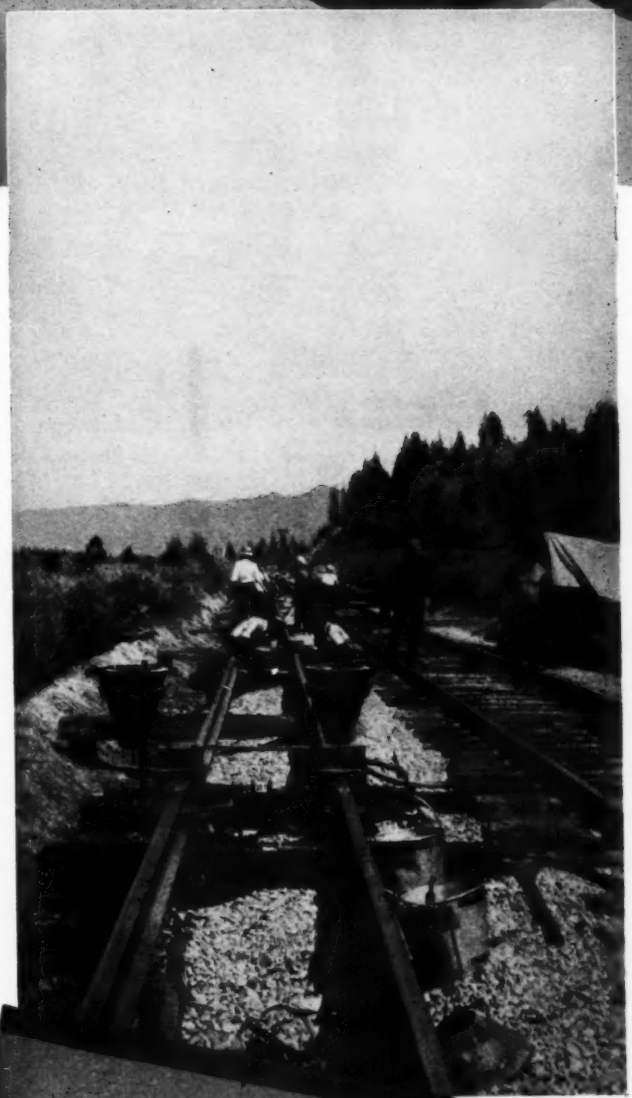

THERMIT WELDING, for continuous welding of rail is used by railroads the world around.

England's London and Northeastern Railway, Great Western Railway, and the London Underground have many stretches of Thermit welded rails 100 to 700 ft. long in service. On the Southern Railway, a mile and a quarter continuous stretch has been laid in a tunnel.

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

APRIL, 1938

Editorials - 243
A Crisis—Ties—Motor Cars

Uses Torches for Cutting Rails - 246
A description of a new rail rehabilitation plant on the Rock Island, where all rail cropping is done with acetylene torches

Track Alinement for Fast Schedules - 250
Professor Kissam, Princeton University, discusses the advantages of string lining as compared with transit lining

Short Circuit Starts Fire in Long Trestle - 252
This article tells how an electrical short circuit caused extensive damage to a 2200-ft. structure on the Illinois Terminal

Rail—Its Most Economical Length - 255
An A.R.E.A. report which discusses the relative advantages of rail lengths in excess of 39 ft.

Derailment on Concrete Roadbed - 257
Abstract of Bureau of Safety report which assigns cause of accident to failure of clip bolts holding the rail

Settlement Causes Tank Leakage - 258
E. M. Grime points out that a rigid substructure is one of the prime requisites to a non-leaking wood water tank

Superelevation for Turnouts - 259
Describes the practice on the London, Midland & Scottish, where this expedient has proved of advantage and entirely practicable

Derailment Pushes Bridge Sidewise - 261
Accident on Norfolk & Western moves ends of adjoining girder spans laterally on pier

What's the Answer - 262

What Our Readers Think - 269

New Books - 270

News of the Month - 271

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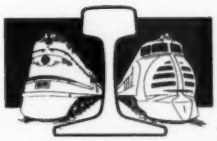
RAILROAD SERVICE

SINCE 1912
OVER A QUARTER CENTURY OF SERVICE
TO THE MAJORITY OF CLASS I RAILROADS

Railway Engineering and Maintenance



A Crisis

Railways Face Most Critical Period

DEVELOPMENTS of vital concern to the railways have followed one another with such rapidity during the last few weeks that it has been difficult for railway employees to realize their full import and even more difficult for the public at large to appreciate their true significance. Yet these developments have precipitated a crisis of such seriousness, not only to the roads but to the nation as well, as to cause the President to summon representatives of the railways, of their employees and of regulatory and legislative bodies to confer with him on a solution of the problem.

While the difficulties of the railways are not of recent origin but have been developing for years, they have been brought to a head by the inadequacy of the rate decision. That such a critical situation should bring out remedial suggestions is not surprising. It is essential that these proposals be studied most carefully in order that no false steps may be taken. Railway employees, who have so much at stake, owe it to themselves to acquaint themselves with all of the facts in order that they may be able not only to formulate their own course of action but contribute also to the constructive thinking of those with whom they come in contact.

What Is the Cause?

What has precipitated this crisis? Has it arisen from the inability of the railways to handle the commerce of the nation? No one contends this, for there has been a surplus of facilities for years.

Has it arisen from the failure of the railways to keep pace with changing conditions in industry? Such a thought is refuted by the revolutionary improvements in service that have been initiated during the last few years —improvements that have preceded industrial demand in many ways and opened new opportunities and new markets for industry.

Has it arisen from a hostile public sentiment? On the contrary, the public at large has never been more friendly or appreciative of the railways than today.

The difficulty does not lie in any of these directions but rather in the relationship between income and expenses. It is commonly recognized that the solvency of any industry and the ability of that industry to render efficient public service do not depend primarily on the volume of gross revenues but on the proportion of these revenues that remain after the payment of operating costs. In railway parlance, this is the net railway operating income.

It is from this proportion of the shipper's dollar that the railways must pay their fixed charges, and dividends if any, with sufficient margin to establish the credit necessary to enable them to finance such necessary improvements as heavier rail, the installation of more and better ballast, etc. It is also through this spread between income and outgo that a railway should be able to develop sufficient reserves to enable it to weather those fluctuations in traffic that occur from time to time.

The Trend of This Spread

The study of this spread affords interesting light on the situation in which the railways now find themselves. In the years prior to government control of the railroads, net railway operating income normally exceeded 25 per cent of gross revenues, the average for the period from 1900 to 1917 being 27.5 per cent. Yet in no year since the return of the railroads to their owners has this spread equalled that in the worst year prior to federal control.

The spread in 1929, the highest that the railways have had since the war, was only 19.9 per cent as compared with 21.8 per cent in 1914, the worst year before the war. The average spread for the period from 1921 to 1936 was only 16.0 per cent, or less than two-thirds of that for the 18 years ending with 1917. In 1932 the spread was only 10.4 per cent and in that year the net railway operating income was less than in any year since 1895, although gross revenues in that year were only 34 per cent as large as in 1932, and the investment in the railroads was only 36 per cent as great. In 1936 the spread rose to only 16.5 per cent.

Since 1936, the railways have been subjected to increases in costs, together with losses in income due to the elimination of emergency charges that, on the basis of the 1936 traffic, totaled more than $302,581,000. As a result of these developments and of the terrific decline in traffic in recent months, the net operating income of the Class I railways of the United States declined to

$6,919,817 in January and it is estimated that they actually failed to earn their operating expenses in February.

The effect of this steadily narrowing spread is shown by the fact that during the last seven years, the net railway operating income of the railways as a whole yielded a return of less than two per cent on their investment, while the equivalent of more than half of the mileage failed to earn its interest and other fixed charges. It is because of this fact also that more than 30 per cent of the railway mileage is now being operated by the courts, a larger mileage than at any previous time in history.

Why This Decline?

Why has this spread declined in this manner and to this degree? Although this trend has been accentuated in the last few months by the drastic decline in traffic, the problem is more far-reaching than this, for in 1932, when the spread reached the all-time low of 10.4 per cent, gross revenues were higher than in any year prior to 1916. The difficulty lies in the fact that the prices charged by the railways have failed to keep pace with the prices that they have been required to pay for the labor and the materials that they have bought. Thus while the index of wholesale commodity prices, based on 100 for the year 1900, had increased to 154.5 and the railway wages to 392.3 in 1937, average revenue per ton-mile increased to a level of only 130.2 and passenger rates had actually declined.

It was to correct this condition that the railways asked for a 15 per cent increase in freight rates, which increase would have added about $437,000,000 to railway revenues. Yet the commission granted increases approximating only 5.3 per cent and yielding the railways only $175,000,000, an amount that, while helpful, is entirely inadequate to meet the present situation and has precipitated the crisis that has now become a national concern.

The Solution

What is the solution? There are those in high government positions who advocate wholesale reorganizations and the scaling down of capitalization. But is that the answer? The total investment that has been made in the railways approximates $25,700,000,000. The Interstate Commerce Commission has placed a physical valuation on their properties as of January 1, 1937, of $22,000,000,000. Yet the net capitalization of the industry is only $18,000,000,000, or less than 75 per cent of the investment and only 85 per cent of the valuation fixed by the commission.

In 1922, the I.C.C. held that the railroads were entitled to earn 5¾ per cent on their valuation, which would approximate $1,265,000,000 on their present valuation. Yet the operating income earned in the final quarter of 1937 would pay 5¾ per cent on a capitalization of less than $8,500,000,000, while the net operating income earned in January and February would pay the return fixed by the commission as fair on less than $1,500,000,000. No reorganization of the properties that could possibly be proposed would reduce their capitalization to any such figures.

Nor is government ownership the answer, for the public has not yet forgotten the lessening of service and the increase in inefficiency that characterized the war-time period of federal control—an experience that created a universal demand on Congress for the early return of the properties to their owners. That this attitude still prevails is revealed by a nation-wide survey of public opinion that has just been made by the American Institute of Public Opinion, in which 70 per cent of those contacted registered their opposition to the government taking over the roads.

The solution to this problem does not lie in wholesale scaling down of capitalization and fixed charges or in government ownership, but in recognition of the fact that the railways must be allowed to increase their charges for their services commensurate with the increases in costs to which they have been subjected. There are other collateral issues, such as the elimination of subsidies to competitors, etc., but they are all secondary to the necessity for greater appreciation by public regulatory authorities of the need for adequate net railway operating income and for a more insistent demand by the public that such income be granted.

It is through such a policy and only through such a policy that an efficient transportation system can be fostered. Such a system is essential to the welfare of a country with distances like ours. Railway employees can contribute to the proper solution of this problem by aiding in the dissemination of these facts among those with whom they come in contact and the public at large.

Ties

Avoid Damage Prior to Insertion

AT NO time in railway history has the conservation of materials received so much attention as at present. This is illustrated by the present attitude toward ties. In the early days when an ample supply of ties could be cut almost within sight of the track, little importance was attached to means whereby their service life could be extended, and when a tie began to show signs of failure it was renewed without question, practically no supervision being exercised to check the necessity for the renewal of the tie.

Supervision was equally lax with respect to the unloading and handling of the ties and to the methods employed to get them into the track. The result was that many ties were damaged before they went into the track, to the extent that their service life was definitely shortened, and certain forms of carelessness in handling grew into established practices.

As the forests along the line were depleted, tie timber became scarcer, making it necessary to go farther afield, and costs began to rise, so that preservative treatment became an economic necessity. Further measures to increase tie life have included larger tie plates, pre-adzing and preboring, the use of anti-checking devices, intensive study of preservatives and methods of treatment, and careful selection of woods for use in specified areas. As a corollary to treatment, stringent rules are now being enforced with respect to manufacture, handling, seasoning and prevention of infection prior to treatment.

That these measures have been effective is proved by the marked increase in the average life of ties, compared

with the earlier period. It will be noted, however, that they relate to the period either before the ties leave the treating plant or after they are in the track. This leaves an interval between shipment and insertion during which it is possible for them to receive forms of damage that will definitely shorten their life.

Habits are difficult to eradicate and practices once established tend to persist. For these reasons, as well as because there is always a certain amount of pressure to keep production to a high level, some of the careless practices connected with tie renewals have continued from the earlier period. Besides, it is often easier to pick up a shovel or a pick that is near at hand than to go some distance for tie tongs. Only by insistence on proper practices, such as care in unloading to avoid bruising the wood, the use of tie tongs while inserting the tie and the use of tie liners or lining bars to shift it into place, as well as close supervision to insure that these rules are observed, can these careless methods be overcome.

The railways are expending much time and effort to give the wood the best protection that is economically feasible. They exercise ceaseless vigilance for months, following the tie from the tree until it emerges from the retorts and is shipped from the treating plant. Supervisors and foremen should recognize their responsibility to see that these efforts are not nullified by the careless use of a shovel, a pick or a sledge during the few minutes necessary to place the tie in the track.

Motor Cars

Should They Be Power Plants?

SUGGESTIONS have come recently from several sources that motor cars be equipped with power plants capable of operating tie tampers, bolt tighteners, spike drivers and the wide variety of small tools that are now being used in increasing numbers in the maintenance of tracks, bridges and buildings, and in hoisting heavy bridge timbers. The basis for these suggestions seems to be that the motor car is now used solely for the transportation of men and tools, that when a gang reaches its work the car is set off the track and remains idle until the gang is through for the day or moves to some other point, and that this idle time should be converted into productive time. The further suggestion has been made that power take-offs be applied to cars now in service, with the idea that they can be used in this way to operate power tools until they are worn out and replaced.

One of the principal arguments advanced in favor of these proposals is that small gangs will thus be afforded the opportunity to use power tools that are not now available to them because of the cost of independent power plants to run them. These proposals have met a favorable reception in some quarters, because they seem to point to economies that are not now open to small gangs.

Section gangs comprise by far the greater number of small gangs, and so far as they are concerned the reasoning is fallacious for the reason that section forces have been reduced to so few men that cars for their use must be as light as practicable. To install a power plant in a section car, with sufficient capacity to operate power tools, would not only necessitate an increase in the weight of the car itself but the added weight of the power plant would place it beyond the ability of the few men now comprising the average section gang to handle it.

Furthermore, the work of these gangs is so varied that the expensive power plant could be used only a small part of the time, which brings the whole matter back to where it started. Moreover, the engines now in section cars are designed primarily for transportation and not for power development, for which reason they are not suitable for the operation of power tools, and their use for this purpose would lack the efficiency, even if they possessed the requisite capacity, that is demanded in powed development. Conversely, an engine that is designed primarily for power development would be equally unsuited for transportation, since it would be larger than is required while the outfit is being used as a motor car.

On the other hand, the engines in large extra-gang cars, being generally of the tractor and truck types, with governors, might be used for the operation of tools if they were provided with power take-offs and special drives, although the advisability of doing so is questioned. Adding a generator to the average extra-gang car would bring the total weight to about twice that of an independent generator set, while if it were an air compressor capable of operating the same number of tools the total weight would be still greater.

When it comes to incorporating a power plant, whether it be a generator or an air compressor, into a motor car, considerations other than those of weight, large engines and idle time are also involved. A feature that apparently has escaped the proponents of this idea is that, fundamentally, the motor car is intended for the transportation of men and tools, and that its utility for this purpose would be seriously hampered by the presence of a power plant. Conversely, this main purpose places a serious limitation on the incorporation of a power plant in a motor car.

It is argued that cars equipped with air-compressors for spray painting are now on the market and that generators are now being built into heavy-duty motor cars. However, the former are designed for special service and low air requirements and are not suited for the general service for which the average motor car must be used. As to the latter, experience has not indicated that they possess sufficient advantages to warrant an extension of their use, while they possess the disadvantages that have been mentioned. For the larger maintenance operations, the trend, which is based not only on experience but on sound economic principles, is definitely toward self-contained units in the hands of specialized gangs. Experience has shown that combination units, designed to perform two or more unrelated tasks, like the jack-of-all-trades, are generally ineffective in all of their applications, and that they are expensive to operate and maintain.

Weighing these factors, it is evident that light motor cars designed for section use are not suited for the incorporation of power plants, because this would be incompatible with the service for which they are designed. While the situation with respect to heavy-duty cars is somewhat different, in that the engines are of greater capacity and of different type, sufficient reasons have been given to show that even in the case of these cars the proposal is highly objectionable.

Uses Torches f

Above—General View of the Rail Reconditioning Plant at Silvis from a Point Near the West End

In the First Step in the Reconditioning Process the Rails Are Straightened In This Hydraulic Press

In a new rail-rehabilitation plant which it has constructed at Silvis, Ill., the Rock Island has provided facilities for classifying, sorting, straightening, cutting and drilling relayer rails. Among the outstanding features of this installation are the cutting machines which embody oxy-acetylene torches as the cutting agent. These and other pertinent features of the installation, as well as its method of operation, are described in this article.

RAIL RECONDITIONING, including the straightening, cutting and drilling of the rails, is now being carried out on a mass-production basis on the Chicago, Rock Island & Pacific, following the completion of a new system rail yard at Silvis, Ill. Completed late in 1936, at a cost of about $22,000, but not operated on a capacity basis until the rail-laying season of 1937, this plant embodies a number of unusual features, notable among which is the practice of cutting the rails with oxy-acetylene torches. For this purpose use is made of the Radiagraph, a device by means of which the cutting operation is subjected to accurate mechanical control. With the rail-reconditioning plant operated on a three-shift basis much of the time, about 250 track miles of rail passed through the yard in 1937.

The construction of the plant at Silvis marks a new departure in the rail-rehabilitation practices of the Rock Island. Prior to about 1929, relayer rail with battered ends was sent to Silvis where the ends were cold-sawed by means of a portable steam-driven saw. However, from about 1925 only rails up to 90 lb. in weight were sawed, while 100-lb. rails were sent to Joliet, Ill., where they were rerolled by a local concern. In 1929, however, both the sawing and rerolling of rails were discontinued and from that time until the completion of the plant at Silvis, rail-rehabilitation work was confined to the building up by welding of the rail ends in track.

Straight-Line Production

The new plant is laid out in accordance with the straight-line production system and is so arranged that the flow of rails through it takes place in an orderly and efficient manner, thus insuring low-cost operation. To facilitate the movement of rails through the plant, a conveyor line is provided which is arranged in a position parallel with the loading and unloading track, an east and west track, and is located 50 ft. from that track. The conveyor itself, along which the rails are moved by hand by the workmen at the various stations, although it is so constructed that it may readily be converted to power operation if conditions should render this desirable, is 2 ft. 10 in. high, and consists of rollers spaced about 5 ft. apart, which are supported at their ends on lines of 56-lb. rails, the bearing housing in each case being welded to the rails. These stringer rails in turn are supported at intervals of 10 ft. on bents constructed of 1¼-in. by 3½-in. channels. Members of similar shape and size serve as longitudinal diagonal bracing between successive bents. At intervals the continuity of the supporting structure of the conveyor line is broken in order to allow workmen freedom of movement in going from one side of the line to the other.

For a total distance of about 180 ft. the conveyor line is protected overhead by a cantilever-type canopy with the side opposite the track boarded up to serve as a wind-break. In addition, at the rail-cutting and drilling stations the conveyor line pierces the walls of small sheds which entirely enclose these operations. The rail-reconditioning plant is wired for electric lights and is floodlighted to permit operation at night.

Straightening the Rails

Rails that are to be thoroughly reconditioned enter the production line near the west end and in successive operations, which are carried out at different points along the conveyor line, they are straightened, the ends are cut off and bolt holes are drilled. In the straightening process all line and

for Cutting Rails

At New Reconditioning Plant

surface bends are removed. For accomplishing this end a hydraulic press is used, which was obtained from an enginehouse where it was no longer needed, and was rebuilt to give it a capacity of 60 tons. The bed of the press consists of a heavy metal casting, likewise obtained from the mechanical department, which is mounted on a concrete base. At each end of the press bed is a roller, 4 in. in diameter and 20 in. long, which operates on roller bearings and which is supported at its ends on vertical coil springs enclosed in steel sleeves.

These springs have sufficient resistance to support any weight of rail that they may be called upon to handle but they give away under the force of the press and allow the rail that is being straightened to bear on metal gaging blocks, one of which is situated on the press bed adjacent to each roller. Because of the additional load which is placed on them at times, other rollers in the conveyor line in the immediate vicinity of the press are of heavier construction than those on the remainder of the line. Like the spring-mounted rollers, they are 4-in. by 20-in. in size, operate in ball bearings at the ends, and are supported in each case by means of two heavy posts. Incidentally, while the rails are being turned from side to side in the straightening press, advantage is taken of the opportunity to make a more careful inspection of them than has been possible up to that time.

Projecting to the rear of the canopy at the hydraulic press is a small entirely-enclosed shed in which is housed the pumping unit that actuates the press. In the front wall of this shed and conveniently situated with respect to the press is an aperture through which the operator, who stands outside the shed, reaches the control lever.

On leaving the press the rail passes on about 100 ft. to the cutting machines, in the course of which movement it is measured for vertical wear

View of the First Rail Cutting Station Showing the Torch of the Upper Radiagraph in Position for Cropping a Rail

Here the Cut Is Being Made as the Radiagraph Moves on Its Track Under Its Own Power

The Top Cut Has Now Been Finished, the Hood Lowered and the Cut From the Under Side Started

with a taper gage and templet and the amount of wear is marked on the rail for use as a guide in piling or loading the rail after it leaves the conveyor line. In the cutting shed there are two cutters which are arranged in series in the conveyor line about 14 ft. apart so that the forward end of the entering rail and the trailing end of the leaving rail may be cut off simultaneously. Between the two cutting stations is a small pit in the concrete floor of the shed into which the rail ends drop as they are severed.

The Cutting Machines

Each cutting station is comprised of two Airco-DB No. 4 Radiagraphs, one for cutting through the head and the upper half of the web of the rail and the other for cutting through the base and the lower portion of the web. Essentially, the Radiagraph consists of a motor-driven oxy-acetylene cutting machine, in which the driving motor, the cutting torch and all control devices are mounted on a small carriage. By means of four double-flanged wheels, each carriage operates on a track 4 ft. 9 in. long, all four wheels being perpendicular to the conveyor line. At each cutting station the two Radiagraphs are so arranged that one is directly above the other, the top machine being above the conveyor line, with the cutting torch pointing downward, and the other being below the line with the torch pointing upward.

The Radiagraph is capable of operating under its own power along its track, and the cutting speed may be controlled by regulating the rate of travel of the carriage, which is accomplished by means of a speed governor control situated on top of the motor. In the Rock Island installation the machines making the top cuts are operated at a speed of 10 to 11 ft. per sec., while those that cut through the lower half of the rails are operated at a speed of 9 ft. per sec. By means of a tachometer mounted on each Radigraph the rate of travel of the machine in feet per second is apparent at all times.

Torch Adjustments

To facilitate the adjustment of the torch in a direction parallel with the track a transmission clutch is provided on each machine by means of which the carriage may be rolled freely in either direction. The torch in each case is mounted on an arm which is provided with controls for regulating the distance of the torch tip from the work, for the inclination of the torch in a plane perpendicular to the conveyor line, for moving the torch back and forth laterally and for bevel cutting. However, only the first two adjustments named are utilized in the rail-cutting operation.

Clamps Hold Rail

At each cutting station it was necessary to provide means of clamping the rails securely in the proper position for cutting. For stopping the rail in the desired position longitudinally, an adjustable stop block is provided at a point just past the first cutting station and another one at a point just short of the second station. In each case the stop block consists simply of a short bar which fits into notches in two horizontal members, one of which is arranged longitudinally on each side of the line of travel of the rails. There are four sets of notches for each bar, which are so spaced that, depending on which pair the bar is placed in, 6, 12, 18 or 24 in. may be cut from the end of the rail.

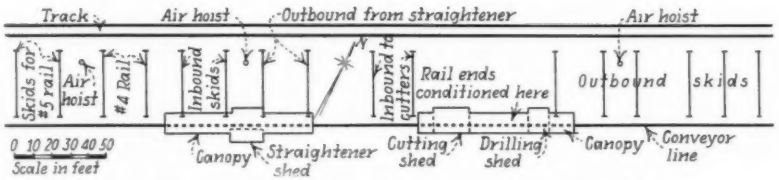
When the rail to be cut has been brought into contact with the stop block, it is moved into the desired position laterally by means of a kick block operated by a lever, after which vertical pressure is applied from above by means of a journal jack for the purpose of holding the rail securely in position. The jack is fastened in a fixed position to a vertical post consisting of a short length of rail. Pressure is transmitted to the head of the rail by means of a metal shoe fastened to the lower end of the shaft of the jack.

Cutting Procedure

When the rail has been fixed in the desired position, the cutting operation is carried out, beginning with the top Radiagraph and following with the lower machine as soon as the top cut has been finished. In starting the upper cut, the Radiagraph carriage, with the transmission clutch in the free-running position, is moved on its track until the tip of the torch is in position over one edge (preferably the edge opposite the gage side) of the rail, after which the flame is ignited with a flint and steel and the clutch released, allowing the Radiagraph to move under its own power at the desired rate of speed.

When the flame breaks through on the other side of the rail head the upper carriage is moved to one side on its track, a hinged metal hood is moved into position over the rail at the location of the cut and the cutting process is repeated with the lower torch, the cut in this case being started on the side opposite that from which the top cut was begun. During the cutting operation both torches are so inclined in a plane perpendicular to the rail that the flame has a slight "drag." When the lower cut has been completed the stop block is removed and the severed rail end drops down a short inclined chute to the pit mentioned previously. After the leading end of the incoming rail has been severed, this rail is moved forward to permit the trailing end to be cut off at the other cutting station while the leading end of the following rail is cut off at the first station.

With this method the actual cutting operation requires an average of about 40 sec. for each rail end. Allowing, however, for the time consumed in getting the rails into position, the combined output of the cutting machines averages about 25 rails per hour, although as high as 35 rails have been cut in an hour. Acetylene for the cutting torches is obtained from the company's existing generating plant at Silvis, while oxygen is also obtained from the existing distribution system in which the tanks are manifolded at a central location and the gas piped to the points of consumption.



Plan Showing Layout of the Rail Reconditioning Plant

Conditioning the Ends

Between the cutting shed and the drilling station there is a space 33 ft. long where the ends of the newly-cut rails are conditioned. In this operation scale is knocked from the rail ends with a hammer and chisel and hand-held portable grinders are used to remove burrs from around the edges of the rail end and to reduce any irregularities that may have been left on the face of the rail and as a result of the cutting operation. In connection with this work each rail end is tested with a try square to insure that a right-angle cut has been

made. Since rails may overlap each other on this section of the conveyor line it is widened slightly and is provided with rollers on two levels to permit one rail to be moved without disturbing the adjacent rail.

For the rail-end grinding work two air-operated grinders are normally used, with air for their operation being obtained from the yard distribution system. In addition, for the use in the event of failure of the air supply, two electrically-operated grinders are also available.

The drilling of bolt holes in the newly-cut rails is done by a twin-chuck drill with a hydraulic feed, which was designed and built especially for this installation. This unit is capable of drilling two bolt holes in about 27 sec., although in practice it is not necessary to maintain this rate. As the bolt holes in the trailing end of each rail are being drilled, a laborer notes the length of the rail from a scale marked on the conveyor line and then, by referring to another scale in the line, he is able quickly to determine the mid-point of the rail and to indicate its position by means of a keel mark. This facilitates later handling of the rails by cranes. From this point the rail passes along on the conveyor line and, as explained later, is shunted off on various skids in accordance with the amount of vertical wear that is present.

Left—Removing Burrs and Scale From the Rail After Cropping. Right—Hand-held Portable Grinders Are Used in Finishing the Rail Ends

Organization Required

When the rail-reconditioning plant is being operated at capacity, with each rail traveling the entire length of the conveyor line without being removed from it, a force of 15 men is required. This includes a foreman, an assistant foreman, one hydraulic press operator, two Radiagraph operators, two grinder operators, one drill operator, six laborers and one helper. Three of the laborers work in the vicinity of the press, two barring rail from the inbound skid onto the conveyor line and one assisting in the straightening operation; one laborer assists the Radiagraph operators; and two assist the drill operator, marking the mid-points of the rails, and moving them along on the conveyor line to the various outbound skids. The helper assists in keeping records and reports and does other odd jobs. The organization also includes a crane operator, a rail checker and three laborers, who unload the rail from cars onto the inbound skids of the conveyor line and who, with the exception of the rail checker, also load the rails onto cars from the outbound skids.

If rail comes into the plant from territory where it is oiled annually as a protection against corrosion caused by brine drippings, it is necessary to remove the accumulation of oil and dirt from the rail ends to insure the proper fit of angle bars. This operation is carried out by two additional laborers and is performed before the rail ends are cut off in order to avoid any possibility of the oil interfering with the cutting operation.

For the handling of rails to and from the conveyor line, eight skids have been provided. These consist in each case of two parallel rails, usually on 21 ft. centers, supported on concrete pedestals which are of graduated heights to give the skids a downward gradient in the direction of movement of the rails over them. Originally it was the practice to construct these skids with the skid rails in the upright position, but experience has shown that the movement of rails on the skids is facilitated when the skid rails are placed on edge on the pedestals, and the more recently constructed skids were built in accordance with this practice.

Rail Classification

For an understanding of the manner in which the different classes of rails are handled at the rail yard an explanation is necessary of the Rock Island's policy in regard to the classification and reconditioning of rails. On this road second-hand rail is divided into four classifications as follows: Rail that has no surface imperfections, not more than 0.1 in. vertical wear, no side wear or flow and is suitable for main line use without cutting is classified as No. 1 rail; rail conforming to the specifications for No. 1 rail except that the ends are battered to such an extent that they must be sawed off is known as No. 2 rail; that which is curve worn or has not more than 1/8 in. side wear and more than 0.1 in. and less than 0.15 in. of vertical wear, is not less than 25 ft. in length, and which may have surface imperfections such as slight burns or scales but no physical defects such as split or piped heads or broken bases, and is suitable for use in light traffic branch lines or side tracks, is classified as No. 4 rail; and that which has been designated as scrap is known as No. 5 rail. No No. 3 designation is used on this road.

All four classifications of rail are shipped to the rail yard for inspection, reconditioning and storage or reshipment as the case may be. No. 1 rail is of course, subjected only to straightening; No. 2 rail is both straightened and cut; and, as a rule, No. 4 rail is straightened only, although in some cases it is considered proper to cut the ends off rail in this classification with the intention of relaying it in secondary main lines.

If conditions permit, rail, on arrival at the yard, is checked for classification and is unloaded into piles in accordance with the weight, classification and length. However, under rush conditions, such as apply during the height of the rail-laying season, the rail is unloaded directly onto the receiving skid at the reconditioning plant, and the preliminary classification made in the field is checked at this time and the length that is to be cut off the ends of the No. 2 rails is marked on them. As the rail moves onto the conveyor line the usual practice is to push the No. 4 and No. 5 rails in the reverse direction on the conveyor to two skids provided for receiving these classifications. If conditions permit, the No. 4 rail is straightened before being sent to the skid, otherwise it is removed to stor-

(Continued on page 261)

Track Alinement for Fast Schedules— How to Maintain It

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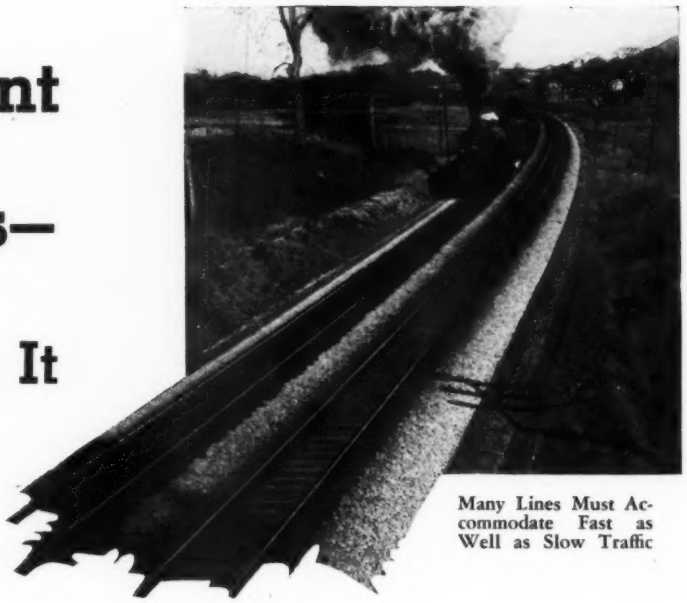


Many Lines Must Accommodate Fast as Well as Slow Traffic

Flexibility of string lining gives it marked advantages over transit lining for day-to-day readjustments of curves for high-speed traffic

WITH THE introduction of high-speed passenger service and the general reduction in schedules of other trains, track alinement has become of increasing importance. Not only do the higher speeds require more perfect alinement but the increased impact necessitates more frequent adjustment. With more work to do and greater accuracy required, railway maintenance forces are faced with a considerable problem. For this reason it is desirable that serious consideration is given this problem and that the available methods for establishing accurate alinement be studied in detail. Every effort should be made to find a method which will produce a precise curve location with a minimum of engineering cost and maximum economy in throwing the track.

The Transit Resurvey

When a curve begins to show signs of poor riding qualities, the natural solution would seem to be to throw it back to its original position. Let us consider just what this solution involves. It is necessary first to determine the correct positions of each of the tangents adjoining the curve, together with the exact location of the point of spiral and the point of tangency. On most curves such a procedure is next to impossible, as monuments showing the location of curve points are seldom set, or, if set, are soon lost.

However, if this can be done, it is presumably possible to restake the curve, using the original degree of curvature and the original spirals. When the line is restaked, it is usually found that the curve, due to many small adjustments of line, has worked a considerable distance out of position and the throws called for are excessive. Not only are these large throws expensive but it is frequently impossible to make them at all, owing to the location of various facilities, such as signals, interlockers, center fences, crossings, etc., which have been built with reference to the track as it lay. Moreover, where more than one track exists, the required clearance for the other tracks frequently prevent large throws from being made.

Transit Method Costly

It is evident that some modification of the original curve is usually necessary. If the work is to be done with a transit and tape, not only is the field work slow and expensive but the computations are involved and tedious, and since it is necessary to cut and try, the best solution is seldom obvious and in most cases is never obtained.

A further objection is met with in the use of the transit. When it is necessary to set up this instrument on running tracks where traffic is reasonably heavy, delays due to passing trains are often frequent enough to keep the work nearly at a standstill. Since, in addition to the preliminary survey, the curve often must be staked out two or three times before an acceptable solution can be obtained, and the use of the transit necessitates the work of trained men capable of careful surveying methods, the cost of engineering becomes altogether too large an item for the purpose that is accomplished.

String Lining an Alternate

It seems evident from the foregoing that some other method of approach must be adopted. As a solution of the difficulty, the method of string lining curves has been in use for many years on some of the larger railroads of this country. Although this method eliminates many of the difficulties inherent in the transit method, maintenance engineers have frequently been reluctant to adopt it as the standard method for track alinement. The chief objections to this method seem to be that it is inaccurate, will not produce the best type of curves and spirals, and that its results are at best a somewhat unknown quality.

String lining was first used as an aid to track foremen in smoothing out a curve, either between line stakes or over short sections badly out of alinement. Using the string, the foreman was able to obtain uniform curvature over short stretches, but he always encountered difficulties in fitting his work to the remainder of the curve. As the track was adjusted piecemeal, the usual effect was to increase the length of spirals indefinitely and to

sharpen the center of the curve unnecessarily. When the work was not carried to this extent, curves lined by this method frequently contained sharp spots near each end, with a flattened center. It is unfortunate that this system should have received the name of "string lining," as actually there is little relation between it and the modern method of string lining curves.

The modern method of string lining embodies a complete computation throughout the entire curve so that the final shape of the spirals, the precise degree of curvature, the size of the throws, and the final clearances are known in advance of throwing the track. The method requires the services of only one trained engineer. Two assistants are necessary, who need no experience whatever, the usual practice being to borrow a couple of section men for the work. Since no instrument is set up, the work is interrupted only momentarily by the passage of a train and the complete data for a curve can be obtained in the approximate time it takes to walk the length of the curve and back.

Contrary to the often expressed theory that string lining is inaccurate, the method is very precise. It is to be remembered that the purpose of track alinement is to provide smooth riding track. The element in curvature upon which smooth riding depends is the rate of change of acceleration toward the center. If the acceleration is constant, as is the case on tangents having zero acceleration, or on the circular part of curves where acceleration is constant, no discomfort is felt by the passengers, nor is any impact applied to the rails; but when the radius changes, the acceleration varies, and these factors become noticeable in direct proportion to the rate of change of acceleration. This can be best understood when one considers acceleration of velocity along a straight line. A constant acceleration can be received without discomfort. One can lean at the proper angle to balance it. But when the acceleration changes, balance is disturbed and impact and discomfort are felt in proportion to the change.

Acceleration toward the center (centripetal force) is equal to $\frac{Mv^2}{R}$ where M is the mass, v is the velocity, and R is radius of curvature. For any given train, the mass and speed are constant so that acceleration varies inversely as the radius. The rate of change of acceleration, therefore, varies inversely with the rate of change of the radius. In order to obtain smooth riding track, the radius should change at a uniform rate, which is as low a rate as possible. A curve, therefore, which has the general shape of a perfect circular arc, but which contains small irregularities throughout, will be found to ride nowhere nearly as well as the curve of slightly varying radius containing no irregularities.

Transit Inaccuracies

When a curve is staked out with a transit, the general alinement of the curve will be very nearly circular but irregularities will appear between adjacent alinement stakes. Illustrated is the result of tests by the author of the accuracy which can be expected when using a transit for alinement. The method of observing was as follows: With the vernier set at an even 10 deg., the instrument was sighted on a plumb-bob held over a tack by hand. Using the upper motion, the instrument was then turned until the vernier was set at 180 deg. from the original setting, a plumb-bob was lined in and its position noted. This process was repeated for each observation, using different initial vernier settings. The diagram shows where the points fell. Three sets of observations were made as follows:

Backsight	Foresight	Number of observations
200 ft.	200 ft.	4
300 "	300 "	6
400 "	400 "	10

The observer was picked for his accuracy. The transit had exceptionally clear graduations and the lighting conditions were excellent. There was no wind.

It will be noted that with a backsight and foresight of 400 ft. each, variations up to ½ in. can be expected. Adjacent stations 50 ft. apart, set by a transit, may differ as much as 1 in. in alinement without discovery. Moreover, ideal conditions obtained during the test shown. A 6¼-in. Berger instrument was used, equipped with an exceptionally high grade circle. The instrument gives splendid results on triangulation with repeated observations. The light during the experiment was excellent, there was no mirage present and as noted the observer was by test exceptionally accurate in his work. Under ordinary conditions, therefore, even greater variations may occur.

When string lining is used, an error in adjacent stations as great at ⅛ in. can seldom occur. It would seem, therefore, that a new curve should first be staked out with the transit and immediately lined by the string method to smooth out inaccuracies. The transit would place the curve in the proper position and the string would eliminate the irregularities. When a curve is already in place, the transit method should never be required for realinement.

String Lining Advantages

There are two general methods of making string lining computations. The first method is used on several railroads and is given in detail in "Field Engineering" by Searles and Ives, 21st Edition, Chapter XIX, under the heading First Method. This method is adaptable particularly to long main line curves which are not badly in need of alinement. It is the more rapid method of the two and offers the simpler method of forecasting the throws.

However, when the curve is in a very bad condition, or when it is desirable to increase the operating speed by lengthening the spirals or increasing the radius, or where the

(Continued on page 254)

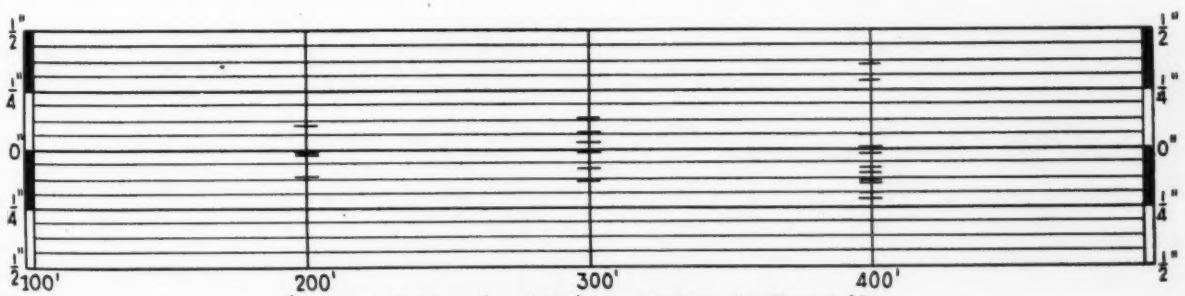


Fig. 1 Errors in Setting Stakes by Transit

The Distances Shown Indicate the Length of Both the Backsight and the Foresight

Short Circuit Starts F

2200-Ft C

The Fire Destroyed 1,500 ft. and Damaged 450 ft. of the Trestle

ALTHOUGH traffic over an important through line was interrupted for more than six weeks by reason of the burning of a creosoted pile trestle 2,200 ft. long and 45 ft. high, the Illinois Terminal is so thoroughly convinced that the preservative treatment of the timber with creosote did not contribute to either the origin of the fire or the extent of the damage, that in replacing the structure it has used creosoted piles and timber throughout.

Starting as a result of the failure of an insulator, which permitted a high-tension power line to fall into the track, the fire consumed 1,500 ft. of the trestle and damaged 450 ft., while 250 ft. was saved from damage. Starting at about 11 a.m. on July 12, the fire broke out simultaneously at a number of points, so many, in fact, that it was impossible to stop it, although fire-fighting organizations from five neighboring communities arrived on the ground quickly. The fire continued for about 4½ hours before it burned itself out, lack of water being an important factor contributing to the extensive destruction which occurred, since only a part of the structure could be reached in reasonable time from the two hydrants available.

The trestle in question, which is known as the "high line" to distinguish it from an alternate line at a lower level, is an elevated structure carrying an extremely heavy freight and passenger traffic. The latter consists of both through trains and the high-speed suburban trains which are operated between St. Louis, Mo., and the numerous communities in Illinois which are served by the Illinois Terminal. Its importance as a traffic link is indicated further by the fact that it forms one of the easterly approaches to the McKinley bridge across the Mississippi river, between Venice, Ill., and St. Louis, which provides the entrance for this road into St. Louis, where it has an extensive freight and passenger terminal.

Carried Important Traffic

Primarily, this trestle was constructed as part of a track elevation project, to get away from the maze of street and railway crossings at grade through Venice and other suburban towns on the Illinois side of the river, which were highly detrimental to both freight and passenger schedules, and which made high-speed suburban service to these communities an impossibility. For this reason all freight and passenger trains, except those doing a strictly local business in the suburban territory, are routed over the high line. Local trains use the old line which passes through these towns at street level.

This trestle, which was built in 1927, consisted of 157 five-pile bents on 14-ft. centers, having 14-in. by 14-in. by 14-ft. caps. The deck consisted of two 3-ply chords of 8-in. by 16-in. by 28-ft. stringers and 7½-in. by 7½-in. by 10-ft. ties spaced 12 in. center to center. Every 56 ft., three long ties projected on both sides beyond the deck to support the steel trolley posts, which also carried two cross arms for telephone and signal wires, and a 2,300-volt power line. The guard rail was fastened to the ties by means of ¾-in. by 11-in. lag screws, and the ties were secured to the stringers by boat spikes ⅝ in. by 12 in. These spikes were not driven home, but projected about ¾ in. above the top of the ties. The height of the deck averaged 45 ft. above the ground.

All Timber Creosoted

All piles were southern pine while all caps and deck timbers were Douglas fir, and all piles and timbers were creosoted, the piles with straight creosote and the timbers with an 80/20 creosote-coal tar mixture. While the specifications called for a retention of 10 lb. of the mixture per cu. ft. for the fir, 9 lb. was all that the timber would take. The average retention for the pine piles was slightly more than 10 lb. per cu ft.

Trains on the Illinois Terminal are operated by electric traction, a situation which is conceded to create a low fire hazard for bridges of the timber-trestle type. However, at the time the structure was built, it was expected that a steam-operated road would use the McKinley bridge and that it would be necessary to route its trains over the high line. For this reason, to prevent fires starting from coals dropped from ash pans of the steam locomotives, heavy galvanized sheets had been placed over the caps and stringers, the latter in such manner as to form a continuous sheet for the full

Fire in Creosoted Trestle

It is believed in many quarters that the treatment of timber with creosote greatly increases the fire hazard surrounding its use. For this reason, it is of special interest that after fire had destroyed a creosoted pile trestle 2,200 ft. long and 45 ft. high, the Illinois Terminal was so thoroughly convinced that the treatment of piles and deck timbers with creosote had not contributed to the loss of the structure that, in replacing it, creosoted material was used throughout. A number of lessons with respect to prevention were learned as a result of this fire, which were applied when the structure was re-built. This article describes the unique origin of the fire, the damage it did and the means employed for preventing a repetition of the disaster.

length of the trestle. These sheets were also in contact with the metal of steel spans which flanked both ends of the trestle. The boat spikes used for fastening the ties to the stringers were driven through the metal sheets over the stringers. Although this structure has never been used to carry steam railway traffic, the galvanized sheets were still maintained up to the time of the fire.

How the Fire Started

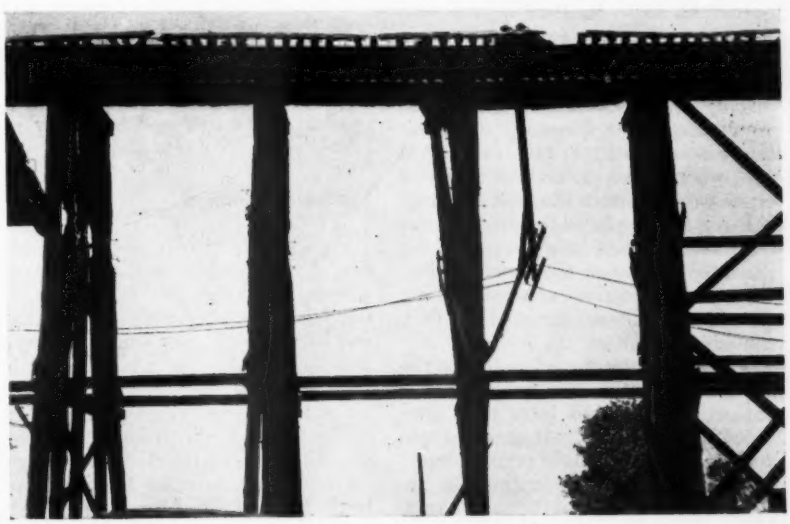
No direct evidence as to the cause of the fire has been adduced, since the structure was burning fiercely by the time help arrived, and so much of it and its appurtenances were destroyed that no physical evidence as to the origin of the fire remained. However, about 11 a.m. on July 12, a trackwalker crossing the trestle discovered a blaze between two ties not far from the middle of the structure and, in attempting to extinguish it, received a shock. Almost at the same time a suburban car stopped on the trestle to allow an employee of the electrical department to get off. As the car moved away, this man noticed fire at a near-by point and called to the trackwalker. Almost simultaneously similar fires were seen to be starting at other points, and both of the men were compelled to drop their tools and run as rapidly as possible from the bridge. Only a few minutes after the first fire was discovered the entire deck was ablaze and flames were creeping down the piles. A brisk wind from the southwest probably contributed somewhat to the rapid spread of the flames, although this was a minor factor, since the evidence is conclusive that the fire broke out with almost explosive force simultaneously at short intervals throughout the length of the structure.

From such other evidence as is available, it is believed that an insulator failed, allowing the 2,300-volt power line to fall and thus come into contact with some of the boat spikes holding the ties to the stringers. In fact, a spectator at a nearby oil station reported that he had seen the wire fall and that this was followed immediately by a burst of flame.

Since these boat spikes were driven through the galvanized sheets which were grounded at both ends by reason of their contact with the steel spans, it is probable that arcs formed between the spikes and sheets at various places. Otherwise, it is practically impossible to account for the simultaneous appearances of fire at so many points throughout the 2,200-ft. length of the trestle. Further evidence that this was the way the fire started was found in the manner in which the deck of the trestle burned.

Some Sections Untouched

An examination of that part of the structure that was damaged but not entirely consumed showed that at certain points the ties and guard rails were burned completely or almost completely through, and that on either side of these places there were whole sections of the deck where the timbers had not been on fire, or were only slightly charred. This localized action was quite as clearly evident in the degree of damage suffered by the pile bents. Corresponding to the effect of the fire on the deck there were entire bents where the piles were untouched by the fire or were only slightly charred at the top, while at other places they were almost completely burned through immediately under the caps. These indications of localized action of the fire, supplementing observations of witnesses, gave de-



Three Spans in the Damaged 450-Ft. Section in Which the Deck Was Badly Burned. The Next Three Spans Were Practically Untouched by the Fire

pendable evidence indicating that the fire originated at the top of the deck of the trestle.

This examination also confirmed the testimony of the trackwalker and electrician that fires started simultaneously at many points. This was shown by the fact that certain parts of the trestle were almost completely consumed, with intermediate sections merely charred. The importance of this is that it shows definitely that the fire was not spread from one point as a result of the oozing or evaporation of the creosote with which the piles and timber had been treated. These facts had a direct bearing on the decision to replace the structure with creosoted material.

Replacement

The clearing of the site of the trestle was started immediately after the fire, and steps were taken at once to replace the structure. Piles and timber were assembled and treated with creosote as rapidly as practicable, and equipment was brought on the ground to handle the work. Pile driving was started on July 22 and was completed on August 19. The placing of the deck followed closely behind the pile driving, and the new structure was placed in service for freight operation on August 24, six weeks and one day after the fire occurred.

In rebuilding the structure, the 1,500-ft. section that was destroyed was redriven as a pile trestle, 535 piles being required. On the 450-ft. section that was damaged, the piles were cut off about 30 ft. above the ground, at the lowest point of damage, and creosoted timber bents were erected on them. As might have been expected in view of the length of the piles required, 65 to 75 ft., they were driven from the top of the trestle. A creeping driver was employed for this purpose to avoid the delays incident to placing the deck and track, which would have been necessary to permit a rail-mounted driver to advance. On the other hand, a crawler-mounted crane working from the ground alongside the trestle placed the frame bents on the shortened pile bents on the damaged section of the trestle. Likewise, a locomotive crane, working from the track level, handled the deck timbers and rails.

To prevent the spread of fire on the structure in case one occurs in the future, 10 fire gaps have been provided by installing 28-ft. steel I-beam spans at approximately regular intervals. As a precaution against the recurrence of a fire from the same cause, however, all wire lines have been removed from the reconstructed trestle and are now carried on the ground on a pole line parallel to the structure, except one trolley wire which is required for operation of the electric trains that use the structure. The sheet metal formerly over the caps and stringers was not replaced.

Water Supply Deficient

As already mentioned, only two fire hydrants were available, one being one block from the south end of the structure, and the other about 2,600 ft. in an easterly direction from the north end. Once the water was turned on, however, and became available at both ends of the structure, no particular trouble was experienced in stopping the spread of the fire. The 250-ft. section that was saved was on the south end where water was most quickly available, and the 450-ft. section that was only partly burned was at the north end, the intermediate 1,500 ft. being completely destroyed. Considerable time was required to lay one-half mile of hose to the north end of the structure, during which time the fire gained such headway that it was not possible to salvage any part of the intermediate 1,500 ft. of the structure. However, water was turned on at the north end in time to stop the fire before it had consumed the north 450 ft. or damaged the pile bent supporting a 60-ft. plate-girder span over the tracks of the Terminal Railroad Association.

It has already been mentioned that wires have been removed and I-beam spans have been introduced into the rebuilt trestle to act as fire gaps. In addition, to overcome the difficulty of obtaining water for fire-fighting purposes, which handicapped the fire-fighting forces in this instance, a 6-in. water line, with fire hydrants spaced 500 ft. apart, has been laid 70 ft. from and parallel with the rebuilt structure. As an additional precaution, the pile bent supporting the 60-ft. span at the north end has been replaced with a concrete pier.

Further Protection

As a still further protection against fire, a hose cart mounted on flanged wheels, carrying 250 ft. of 2½-in. fire hose, has been placed at the east end of the McKinley bridge where it will be available for use on both the high line and the McKinley bridge. To provide access from the top of the bridge to the fire hydrants serving the structure, three steel ladders have been installed, reaching from the deck to the ground, one at each end of the structure and one near the middle.

With the wire removed from the trestle, it is believed that the chance for another fire is rather remote. If one does occur, however, it is believed that the fire stops, the readily available water and the remaining facilities that have been mentioned, should make it possible to extinguish it before it can spread.

Track Alinement

(Continued from page 251)

throws are closely limited, the complexity of the problem makes it necessary to use a more direct method of computation than mentioned above. This method is described in detail in the same chapter of Searles and Ives under the title Second Method, also in Railroad Curves and Earthwork by Allen, Chapter XVIII, 7th Edition, and in *Railway Engineering and Maintenance* for January, February, April, May and June, 1928 (since reprinted in booklet form). This method is of more general application, for it will produce the exact curve desired, as compared to the smoothing out of irregularities to which the first method is best adapted. The drawback is the multitude of small arithmetical computations necessary, any one of which can partially invalidate the results when a blunder is made.

Adapted to Any Curve

As has been pointed out, the string lining method is not only advantageous from the point of view of economy in engineering and in the throwing of track, but it provides a method which is simple in the extreme for adaptation to the most complicated types of curvatures. It is quite as easy to make the necessary computations for string lining spirals and compound curves as it is for computing simple curves.

With so many factors in its favor and with a rapidly increasing need for accurate alinement, it is hard to understand why the string lining method is not in more general use today. Unquestionably it is the method of the future, as it provides the only solution for higher speeds on present track. Where frequent and accurate track realinement will be the rule, its general adoption will undoubtedly follow a careful trial. It remains only for the pressure of fast schedules and a realization of the large factors of time and expense involved to arouse maintenance men to the necessity of discarding the old transit method in favor of modern string lining methods.

Rail—

What is its Most Economical Length?

A.R.E.A. report, abstracted herewith, works out the relative economy of 78-ft. rails as compared with 39-ft. rails, and shows that many roads would turn to lengths greater than the present standard if these lengths were made available at no large premium in cost.

WHAT is the prevailing attitude among railway officers as to the most desirable length of rail, and what are the economic advantages of a 78-ft. rail as compared with the present standard 39-ft. rail? These questions were considered during the last year by a sub-committee of the Committee on Rail of the American Railway Engineering Association, and reported upon at the convention of the association in Chicago, March 15-17.

To secure a representative answer to the first question, the committee sent a questionnaire to all Class I railways, which have a total road mileage of 237,000 miles. Replies were received from 58 roads or systems with a total of 215,039 miles of lines, or approximately 91 per cent of the mileage in the United States.

Summary of Replies

A summary of these replies shows that 21 roads expressed a preference for the present standard 39-ft. rail; 10 expressed a preference for rails 45 ft. in length; 1 indicated that it preferred rails 50 ft. long; another indicated its desire for rails in lengths of 58 ft. 6 in.; 3 roads expressed a preference for 66-ft. rails; still another road, which is experimenting extensively with continuous welded rails, expressed a preference for rail lengths of 117 ft.; and 18 roads indicated their preference for 78-ft. rails, twice the present standard length. Only three of the roads reporting indicated no preference in length. The names of the roads answering the questionnaire, together with their mileage and their expressed preference as regards rail length, are shown in one of the accompanying tables. Another table summarizes the replies received, and from this table it will be observed that 69.3 per cent of the mileage which reported is in favor of a rail length in excess of 39 ft., and that 40.4 per cent of the mileage which reported on the question is in favor of rail lengths of 78 ft. or longer.

In considering those roads that expressed a preference for 78-ft. rails, it should be noted that two of them, the Alton and the Chicago, Burlington & Quincy, indicated no special preference between 78-ft. and 66-ft. rails, and that the Missouri Pacific did not restrict its preference to 78 ft. rails, indicating that it favored the longest lengths that can be rolled economically. It should be noted in this connection also that several other roads predicated their preference for 78-ft. rails on the assumption that there would be no appreciable added cost per gross ton for rails of this increased length.

In recognition of the fact that a considerable period of time would be required to determine the relative economic advantages of 78-ft. and 39-ft. rails from a comparison of their service performance, the committee presented the following analysis of the respective benefits of the two rail lengths, basing its comparison on rail of 127-lb. Dudley section.

Advantages of 78-Ft. Rail

The average life of 127-lb. rail in main track, in its first location, may be assumed to be 200 million gross tons of traffic carried. During this period it would be necessary to apply reformed bars and to build up the joints twice, at an estimated cost per joint, as follows:

Labor to remove old bars and to apply reformed bars	$0.15
Reforming cost	1.00
Welding rail ends twice	1.50
Total cost per joint	$2.65
Estimated first cost of joint	5.00
Applying reformed bars and welding	2.65
Total	$7.65
Less salvage	2.50
Net cost per joint	$5.15

Since in one mile of track there would be 135 joints saved through the use of 78-ft. rail, this represents a total saving during the life of the rail of

$$\frac{135 \times \$5.15}{200} = \$3.48 \text{ per gross ton.}$$

The cost of routine joint maintenance is estimated as follows:

Tightening bolts once a year, 6 bolts at 0.01 man-hour per bolt at 40 cents	2.4 cents
Oiling joint	1.0 "
Spotting up joint once per year, ½ man-hour at 40 cents	20.0 "
Total maintenance cost per joint	23.4 cents

For 78-ft. rail, 135 joints would be eliminated, or

$$\frac{135 \times 23.4 \text{ cents}}{200} = \$0.158$$

per gross ton per year would be saved in annual maintenance expense. This, at 5 per cent, would represent interest on an additional investment of $3.16 per gross ton. Some saving in equipment maintenance would no doubt also result, but the actual value of this is difficult to determine.

Assuming one rail failure in five miles of track per year and that 78 ft. rather than 39 ft. of rail is scrapped because of this failure, then the added cost per year of the longer rail would be

$$\frac{\$10 + 0.74\ (\$45 - \$15)}{5 \times 200} = \$0.032$$

per gross ton per year, which, at 5 per cent, represents a capital investment of $0.64.

In accordance with the foregoing, the net savings for 78-ft. rail would represent a benefit in capital investment, at 5 per cent interest, as follows—per gross ton:

Joint bars, reforming and welding eliminated	$3.48
Routine joint maintenance eliminated	3.16
Reduction in cost of unloading and laying at $40.00 per mile	0.20
Total benefits	$6.84
Less increased cost due to rail failures	0.64
Net benefits	$6.20

This would indicate that if 78-ft. rail could be obtained at substantially the same base price as present rail, appreciable benefits would be realized. However, an increase in base price due to the longer length would substantially reduce these economies.

Preference Expressed by Roads in Rail Lengths in Excess of 39 Ft.

Length Preferred	*Name of Railroad*	*Road Mileage*
39 ft.	Akron, Canton & Youngstown	169
	Atlanta, Birmingham & Coast	637
	Baltimore & Ohio	6,471
	Boston & Maine—Maine Central	2,986
	Florida East Coast	685
	Grand Trunk Western	1,027
	Gulf Coast Lines—I.G.N.	2,400
	Gulf, Mobile & Northern	900
	Lehigh & New England	215
	Minneapolis & St. Louis	1,500
	M. St. P. & S. S. M.	4,850
	Missouri-Kansas-Texas	3,300
	New York Central	12,000
	N. Y. C. & St. L.	1,700
	N. Y. O. & W.	576
	Norfolk Southern	835
	Southern Pacific System	13,500
	Southern Railway System	8,000
	St. Louis Southwestern	1,750
	Texas & Pacific	1,950
	Virginian	600
	Total (21 Roads)	66,051
45 ft.	Atlantic Coast Line	5,102
	Chesapeake & Ohio	3,106
	C. & N. W.—C. St. P. M. & O.	10,048
	C. M. St. P. & P.	11,000
	Chicago Great Western	1,500
	Great Northern	8,100
	Pere Marquette	2,116
	Seaboard Air Line	4,300
	Western Maryland	883
	Western Pacific	1,200
	Total (10 Roads)	47,355
50 ft.	Pennsylvania	10,700
58 ft. 6 in.	Norfolk & Western	2,200
66 ft.	Bangor & Aroostook	604
	Bessemer & Lake Erie	226
	Mobile & Ohio	1,200
	Total (3 Roads)	2,030
78 ft.	Algoma Central & Hudson Bay	323
	Alton (either 66 feet or 78 feet)	956
	A.T. & S.F. System (If standard changed)	13,500
	Bingham & Garfield	33
	C.B. & Q., inc. C. & S.-F.W. & D.C. (66 ft. or 78 ft.)	10,777
	Chicago & Illinois Midland	132
	C. R. I. & P.	8,000
	D. & R. G. W.	2,600
	Erie	2,400
	Illinois Central (Provided extra cost does not exceed $4 per G. T.)	6,800
	Kansas City Southern	879
	Lehigh Valley	1,320
	Louisville & Nashville (Conditional)	4,900
	Missouri Pacific (Favor longest length that can be rolled)	7,200
	N. Y. N. H. & H.	2,000
	R. F. & P.	118
	St. L.-S.F. (If made standard)	5,400
	Union Pacific (If economically justified)	10,000
	Total (18 Roads)	77,338
117 ft.	Delaware and Hudson	830
No Preference Expressed	E. J. & E. (Interested in longer rail)	435
	Northern Pacific (Favor longer rail but not ready to specify length)	6,700
	Reading	1,400
	Total (3 Roads)	8,535

Joint Gap

One other road has made an analysis of the relative cost of 78-ft. rail as compared with 39-ft. rail, and, by a process somewhat different from the foregoing, has reached the conclusion that the economy in the use of 78-ft. rail would be $3.89 per gross ton.

The question has been raised whether with an increase in rail length from 39 ft. to 78 ft. the greater average joint gap might not increase the impact at the joint to the extent that much of the maintenance saving anticipated in the elimination of joints would not be realized. Theoretical calculations have been made to determine to what extent the joint impacts would be affected by a wider joint gap. Actually, since the rail drilling with both 39-ft. and 78-ft. rail permits the same maximum joint gap, there is some question whether the average joint gap will, in reality, be any more with 78-ft. rail. Furthermore, the results of studies of wheel impact,

made by the "Rails Investigation" at the University of Illinois, indicate that an increase in the average joint gap from ⅛ in. to ¼ in. would not appreciably affect the impacts developed by wheels and should not, therefore, be expected to reduce materially the anticipated economies resulting from the reduction in the number of joints.

In concluding its report, the committee stated that, before committing itself to a longer standard rail length, many roads are giving careful consideration to the following factors: The ability to handle long rails with small section crews; the availability of cars for transporting the longer rails; the effect of rail-end hardening in minimizing joint maintenance costs; and the developments which are taking place in the practice of welding two or more rails together in the field.

Summary of Replies to Questionnaire on Rail Lengths in Excess of 39 Ft.

Length of Rail	Number of Roads in Favor	Road Mileage	Percent of Total Mileage Reporting
39 ft.	21	66,051	30.7
45 ft.	10	47,355	22.0
50 ft.	1	10,700	5.0
58 ft. 6 in.	1	2,200	1.0
66 ft.	3	2,030	0.9
78 ft.	18	77,338	36.0
117 ft.	1	830	0.4
No preference	3	8,535	4.0
Total	58	215,039	100.0

Failed Rail Fastenings Cause Derailment on Concrete Roadbed

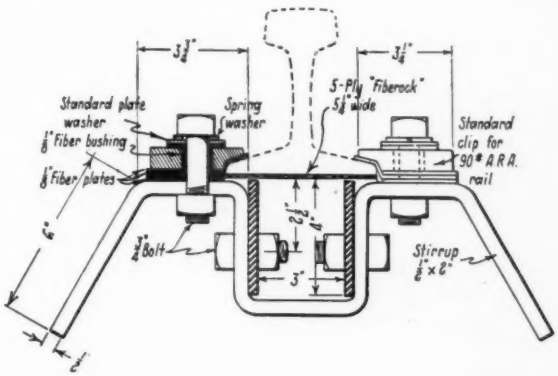
FAILURE of clip bolts that held the rails on the concrete roadway slabs of the Pere Marquette at Beech, Mich., was the reason given by the Bureau of Safety of the Interstate Commerce Commission for the derailment of a passenger train on December 17, 1937. The train was traveling between 45 and 52 miles an hour at the time of the accident, which resulted in the injury of 34 passengers and employes.

Design of Support

The concrete-supported track, which is in the westbound track of a double-track line, was constructed in two units of somewhat different design, and the derailment occurred on the part that was built first (in 1926). This consists of a quarter mile of track in which the rails are supported on reinforced concrete slabs of rectangular cross section. The rails are held in place by means of clips that are bolted at intervals of 27 in. to steel stirrups embedded in the concrete just below the top of the slabs.

The bolts used to secure the rail-clips to the stirrups are ¾ in. in diameter and 2½ in. long. To provide insulation for the rails, a fibre plate ⅛-in. thick by 5¼-in. wide is placed beneath the base of the rail for its entire length, fibre plates are also placed under each rail-clip and the bolt-hole in the stirrup is bushed with fibre. To overcome excessive rail batter, all the rails were butt welded in 1933 and 1935.

The point of initial derailment was 731 ft. west of the east end of the concrete roadbed, and following the accident it was found that 261 clip bolts had been broken off on the outer side of the north rail west of the point of initial derailment, allowing the rail to be pushed outward. The concrete roadbed was covered with two inches of ice at the time of the accident.



Section Showing Construction of the Rail Fastenings in the Concrete Slab

Concrete Not Defective

From the testimony of the section foreman, roadmaster and division engineer during the investigation of this accident, it was shown that there had been no deterioration of the concrete and no settlement or movement of the slabs, but that trouble had been experienced with the rail fastenings on the first installation (the one on which the derailment occurred) from the time that it was placed in service. During 1937, up to the date of the derailment 410 of the clip bolts had broken. As many as 150 broke in a single month, the foreman reporting that he had replaced 8 or 10 of them in one day. He said that they had given more trouble recently and thought that the bolts were becoming weaker because of the effects of corrosion.

It was also brought out that the rail fastenings allowed the gage to widen so that it had been maintained rather uniformly at about 4 ft. 9 in. However, after the accident it was found that the gage on that section of the track east of the point of derailment ranged from 4 ft. 9 in. up to 4 ft. 10½ in.

Swelling of Insulation

The insulation used under the rail and under the rail clips in this installation is subject to swelling when water-soaked, and the division engineer advanced the theory that due to a rain which fell two days prior to the accident, saturation took place and the freezing temperature which followed the rain caused swelling of the insulation sufficient to raise the clips and permit the base of the rail to move outward under the pressure of the weight of a train. The division engineer also stated that the manner in

which the rail was bent around the last anchor bolt which remained in place, suggested that a powerful blow of some kind delivered near that point had initiated the outward movement of that rail, but, according to the Bureau of Safety, nothing to substantiate this theory was found.

Settlement Causes Tank Leakage*

By E. M. Grime

Engineer of Water Service,
Northern Pacific, St. Paul, Minn.

LEAKAGE between the staves of wooden tanks is one of the most annoying problems that confront the men who are charged with the maintenance of locomotive water facilities. This leakage is seldom the result of decay originally, but it soon leads to it, not only in the tank proper but also in the substructure or frame if it is of timber. This form of leakage is caused primarily by unequal settlement of the tub by reason of decay or settlement of one or more of the supporting posts.

Cause of Settlement

It is practically impossible to select timber of such uniform quality for the 21 long posts ordinarily required for the substructure of a 100,000-gal. tank, that at least one or two of the posts may not start to crush or else fail by reason of some defect, as unsound knots, shake, etc., before the remaining posts give indication of failure. While the tank floor is supported directly on rails or I-beams, these usually rest on timber caps which, in turn, rest directly on the posts. It is obvious that settlement of a post will allow a part of the tank above to settle slightly out of position. Such settlement usually results in leakage between the staves, destruction of the chime or other defect tending to start leakage.

When leakage is discovered, a carpenter gang is sent to replace the post or to splice in a "boot" at the base of the post, replacing the defective part. This may make the structure safe, but it is not usually feasible for the men to raise the post exactly the right amount to force the staves back into their original position and leakage, even if apparently stopped at the time, soon shows up again. Thereafter it becomes a leaky tank which is always a spectacle for criticism, particularly during cold weather when accumulations of ice make the leakage so evident.

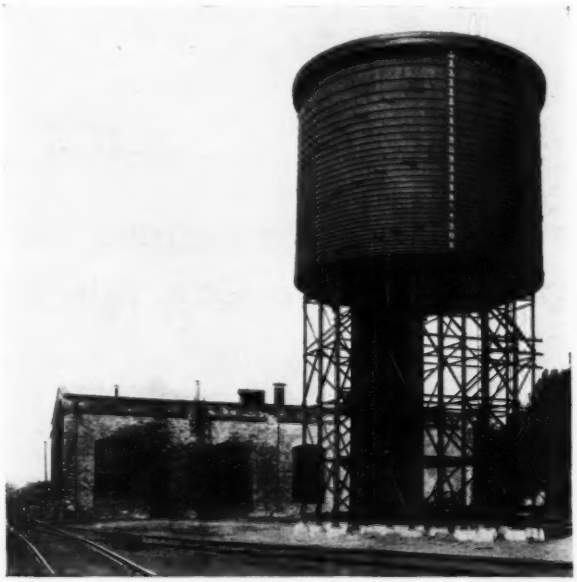
A 100,000-gal. tank supported on the ordinary design of frame which calls for 21 posts 12 in. by 12 in., stresses the timber to 250 lb. per sq. in. While this may not be excessive, when one or more posts fail to carry their full allotment of the load, the strain on adjacent posts soon becomes excessive and their decay and failure are hastened.

Service Life of Tanks

By careful maintenance, a wooden tank on a timber substructure can usually be made to last from 30 to 35 years. It appears, evident, therefore, that if such a tank be supported on a rigid substructure, such as steel, thus eliminating settlement, the life of the tub may reasonably be assumed to be at least 50 years. Where such a life can be attained, this type of structure becomes economical. Leakage will be eliminated, provided the tank is kept reasonably well filled to avoid the drying out of the staves.

Will Last Indefinitely

A steel-frame substructure consisting usually of 5-in. by 5-in. angle posts and 3-in. by 3-in. bracing, with 10-in. I-beam caps, will last indefinitely if it is kept painted. Since it is put together with bolts, it can be dismantled readily, with no loss of salvage, for movement to a new location. This point is worthy of consideration in these days of extended locomotive runs, larger locomotive tenders, and other changes which tend to effect the permanency of the water-service facilities of the railways. The structure of this type, which is shown in the illustration, is now eight years old and so far has required no repairs of any kind or maintenance, except the regular painting which is scheduled to be done at intervals of five years.



Steel Frame Substructures Will Last Indefinitely If Kept Painted

*This discussion was submitted for publication in the January issue, in answer to a question concerning the causes of leakage between the staves of wooden tanks and how it can be stopped. Owing to its scope it was withheld for presentation here as an independent article. For other discussions of this subject, see page 41 of the January issue.

EXPECTS LOWER CARLOADINGS—A decrease of 24.8 per cent in carloadings for the second quarter of 1938 as compared with the same period of 1937 is expected to take place in the Allegheny region by the shippers advisory board of that region. Decreases are expected in loadings of all commodities except grain, fresh fruits, livestock, canned goods and enamelware. An increase of 150 per cent is expected to take place in loadings of fresh fruits. A 20 per cent decrease is expected in coal and coke, a 50 per cent decrease in iron and steel castings and 45 per cent in iron and steel scrap.

A High-Speed Junction, with Superelevated Turnout Curves, on the London, Midland & Scottish.

Superelevation for Turnouts

London, Midland & Scottish has found this expedient of advantage in increasing the permissible speed at main-line junctions

THE superelevation of turnout curves is a refinement that is now being introduced on the London, Midland & Scottish as a means of obtaining greater speed through switches with comfort and safety. This measure is one of several that have been applied to improve the riding qualities of turnouts where high speeds are desirable; for example, at the junction points where two main lines converge. Apparently, it has not been applied to the turnouts of crossovers. Since the bull-head rail is used, the manner of introducing superelevation in turnouts involves adjustments in the height of the chairs in which the rails are supported. Since this feature is not applicable to American practice, only such details of the method are described as are essential for an understanding of the general principles involved.

The longest standard planing on switches of the L.M. & S., is 1 in 80, or a switch angle of about 43 min. The more frequently used planing angles are 1 in 64 (54 min.), 1 in 48 (1 deg. 12 min.) and 1 in 40 (1 deg. 29 min.), the most commonly used switch being the one planed to an angle of 1 deg. 12 min. A simple turnout may be divided into three parts from the standpoint of movements over it: (1) The angle of divergence of the planing, the curve in the switch rail back of the planing and the curve in the closure or turnout rails. It is general practice in England to curve switch rails beyond the heel of the planing. In studies for the improvement of switches, consideration was given to planing that would provide curvature on the gage side well up to the point, but this was deemed an impractical refinement.

A "Natural" Frog

According to English usage, the No. 12 frog is the "natural frog" for use with a 28-ft. 6-in. switch point planed at an angle of 1 deg. 12 min. (1 in 48) because in this case the curvature in the switch point beyond the planing is the same as the curvature in the closure rails, namely, 4 deg. 9 min. The lead is about 97 ft. However, investigation indicates that this combination produces an unbalanced condition as to lateral thrust, this being at a maximum as the equpiment enters the turnout, owing to the abrupt change of direction produced by the switch point angle, and appreciably less after the locomotive or car gets onto the turnout curve. This same condition obtains with all the standard turnouts, the thrust at the point of the switch being out of proportion to that of the switch point curve, and led to the proposal to use a planing that provides a more acute angle without increasing the radius of the switch point curve. This plan has been applied to the No. 12 turnouts, using a 33-ft. 6-in. switch point planed to an angle of 54 min., with a marked improvement in riding quality. In fact, it is contended that the application of the same switch point to a No. 10 turnout would also prove of advantage. Similar improvements have been made by similar combinations with other frog angles.

It has been the practice in the past to introduce some superelevation in turnout curves by adzing the ties under the inner rail and by introducing shims under the chairs that support the outer rail. But both practices are objectionable, the former because it involves the abuse of treated timbers and the latter because it reduces the grip of the lag screws that hold the rail chairs to the ties. This plan has the further objection that it does not permit the superelevation to be started soon enough, since it cannot be introduced into any part of the switch points which are supported, together with the stock rails, in standard switch-rail chairs in which the bearings for the switch rails and stock rails are at the same elevation.

To overcome these objectionable features the rail chairs have been redesigned so that the switch point for the turnout, namely, the outer rail for the turnout, is raised progressively from the heel of the planing to the heel of the switch rail, at which point the turnout rail is 1 in. higher than the main track stock rail. As the switch point must be level with the stock rail for the length of the planing, it is necessary, of course, to put a vertical kink in the switch rail at the heel of the planing. The planing on the 33-ft. 6-in. switch point extends 14 ft. 8 in. from the point and the set of vertical link occurs 15 ft. 2½ in. from the point.

The use of chairs of progressive increase in height is continued beyond the heel of the switch rail until the outer turnout rail is 1½ in. above the normal height, relative to the ties, and this height is maintained for the remaining distance to the frog. As the main track rail on the frog side must be at the same elevation as the turnout rail at the frog, this main track rail must be raised on variable-height chairs in the same manner. However, as it is necessary to maintain cross level on the main track rails (assuming that the main track is on tangent) and as chairs under the outer main track rail are of normal height, it is necessary to introduce another expedient, namely, a variation in the superelevation of the switch ties. Thus, by starting with the ties in cross level at the point where the outer turnout rail is raised 1½ in. and gradually putting the ties on a "rake," as the English term it, until the tie at the toe end of the frog is 1½ in. higher under the outer main track rail than it is under the toe of the frog, this rake will compensate for the 1½-in. difference in the height of the chairs under the two rails. The two main track rails will thus be kept in cross level.

Turnout with No. 16 Frog Assembled in a Yard—Note How Combination of Canted Ties and Variable Height Chairs Produced Desired Superelevation

However, as has been noted, this expedient results in a raise in the tangent or through route of 1½ in. within about half the length of the turnout. It is said that this does not produce any noticeable effect in trains moving over the through route at any speed.

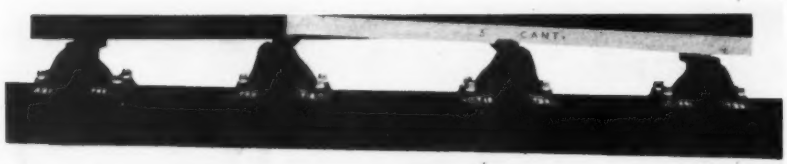
The inner rail of the turnout is also supported on chairs of normal height throughout its length, but by reason of the rake in the ties, the inner rail chair support on the ties at the toe of the frog is 1½ in. lower than the chair support under the toe of the frog, and because the chairs at the frog are 1½ in. higher, the turnout has a superelevation of 3 in. at that point.

This arrangement implies, of course, that the turnout track continues on a curve in the same direction beyond the frog, so that the short stretch of tangent through the frog is of no consequence. However, it has been suggested that the railways might well consider the possibility of a further refinement in the form of a frog with curved turnout rails for use in such cases.

As an illustration of the reduction in speed restrictions effected by this refinement in junction turnouts, the case is cited of No. 16 turnouts developed for a double-track diversion from a double-track tangent main line. Without superelevation this turnout is estimated to "be worth" 35 m.p.h., with a probable slow order of 30 m.p.h., while with a superelevation of 3 in. the same turnout is estimated to "be worth" 55 m.p.h., with a probable speed restriction of 50 m.p.h.

Attention has been directed, also, to the opportunity to apply these combinations of risers of various heights with various amounts of "rake" in the ties in a wide variety of combinations. For example, in cases where the demand for speed on the turnout route is especially urgent the proponents of this plan suggest the advisability of throwing the tangent track out of cross level at the frog by as much as an inch for the purpose of gaining a corresponding increase in the superelevation of the turnout.

The development and application of the designs for superelevated turnouts for high-speed movements have been carried out under the direction of W. K. Wallace, chief engineer, London, Midland & Scottish, and E. H. d'E. Darby, engineer maintenance of way.



Left—Two Rail Shoes Used Near Heel of Switch. Below—Rail Supports Between Switch and Frog

Derailment on Bridge Pushes Spans Sidewise

THE lateral skidding of two girder spans on the top of the pier on which their adjoining ends rested was the extraordinary feature of a derailment on the Norfolk & Western near Bluefield, W. Va., on November 20, 1937. While the cause of the accident was not definitely determined, the circumstances are worthy of review. The train involved consisted of five passenger train cars and a heavy 4-8-2 locomotive; two persons were killed and 72 injured as a result of the accident.

According to the Bureau of Safety of the Interstate Commerce Commission, the initial point of derailment occurred on a 7-deg. 7-min. curve about 12 ft. east of the pier supporting the adjoining ends of two-deck girder spans each 62 ft. long. The train was eastbound and all of the equipment passed beyond the east end of the bridge before it came to rest.

The locomotive was not derailed, the first wheels to leave the track being those of the front truck of the tender. However, no wheels of the rear tender truck or of the following car were derailed, but the last four cars were completely derailed and two of them were turned over.

Superelevation

The bridge has an open deck, but the five-inch superelevation for the 7-deg. 7-min. curve was effected by tilting the spans by means of beveled steel shoes of unequal height. Originally, these shoes were anchored to the masonry, but about five years ago, when the shoes were blocked up on eight-inch timbers to compensate for an equivalent ballast raise, no provision was made for anchoring the shoes to the bridge seat in their raised position. The bridge was built in 1912 and was rated for a live load of E 56.

It was rather definitely established that the speed of the train at the time of the derailment did not exceed 40 miles per hour, and no question was raised as to the safety of operation of trains at this speed on the curve with a superelevation of 5 in. The track was badly damaged and two rails were broken, but careful examination led to the conclusion that all track defects were the result of rather than the cause of the accident. The same conclusion was reached with respect to the condition of the equipment.

In addition to the track damage, it was found that the ends of the girders on the pier had moved north or out from the curve a distance of four feet. Under the girders on the inside of the curve both the shoes and raising blocks moved with the span, while on the high side the shoes slid on the raising blocks and came to rest beyond the end of the wood blocking, so that the girders on the outside of the curve were being supported largely from the low side girders by means of the sway braces. Except for several broken lateral braces, the girders were not injured.

Discussion of the accident in the report is concluded with the following statement:

"The results of this investigation point to the probability that the bridge, or the alignment of the track on the bridge, was slightly distorted by the engine of this train, or by preceding trains, sufficiently to cause derailment of the forward tender truck wheels and some of the wheels of following cars, and that the derailed wheels and the momentum of the train set up forces in the track and bridge which forced the bridge out of position and broke the rails east of the bridge."

Torches Used For Cutting Rail

(Continued from page 249)

age piles and returned to the conveyor line for straightening at a time when there is less pressure for handling main-line rail. However, if at all possible, the No. 4 and No. 5 rails are segregated on the car during the unloading process, in which event they are transferred directly to storage or scrap piles as the case may be.

All No. 1 rail going on the receiving skid is straightened and then barred off the conveyor line onto an out-bound skid just beyond the press, from which it is either loaded directly for shipment or is removed to storage piles. No. 2 rail, since it is both straightened and cut, moves the entire length of the conveyor line. If the reconditioning plant is operating with a reduced force so that only one or two operations can be carried out simultaneously, this rail is first straightened and barred off onto the out-bound skid from the press, from which it is later transferred to an in-bound skid leading to the cutters by means of a crane.

At the leaving end of the conveyor line the rail is shunted off on three skids in accordance with the amount of vertical wear, the object being to facilitate the task of loading or storing together rails within a given range of vertical wear. More specifically the practice is to place in the same storage pile rails in which the vertical wear is within a range of 0.02 in.

Air Hoists

While the rail yard at Silvis is equipped with a locomotive crane for loading and unloading rails, it was necessary to provide supplementary means of handling rails to and from the skids and cars and, in some cases, from one skid to another. For this purpose three air-hoists have been provided which were built by the railroad largely with material already at hand. One of these is located between the skids for No. 4 and No. 5 rails, another is placed between the receiving skid and the out-bound skid from the straightener, and a third is located between two of the out-bound skids at the leaving end of the line. In addition it is planned to construct a fourth hoist of the same type beyond the last skid at the leaving end of the line.

Each hoist embodies a vertical mast consisting of a 10-in. by 10-in. built-up bridge member 18 ft. high, carrying a 24-ft. horizontal boom capable of swinging through a horizontal angle of about 180 deg. The air cylinder on each mast is 9 in. in diameter and the piston has a vertical movement of about 5 ft. Thus, since the load line and sheaves are so arranged that the lift is twice the distance the piston moves, the maximum lift of which each hoist is capable is about 10 ft.

The rail reconditioning plant at Silvis was designed and constructed under the direction of W. H. Hillis, engineer maintenance of way of the Rock Island, J. G. Wishart, principal assistant engineer and L. J. Turner, special engineer. O. F. Ingwersen is the foreman in charge of the yard.

Effect of High Speeds on Track

What effect do the higher speeds of today have on track maintenance? Why? Do the types of motive power and cars make any difference?

More Refinement Needed

By G. S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

Higher speeds call for greater refinement in line and surface than has been considered necessary for ordinary speeds. This in turn necessitates higher standards with respect to rail, fastenings, turnout design, curves, tie condition, ballast, drainage and roadbed. This applies with particular force to turnouts and curves, for elevation and spirals must be revised to insure comfortable riding and turnouts must be lengthened. If this is done with due regard for the fact that in most cases other trains must use the same track, the adjustment of curve elevations can be made without causing excessive maintenance as a result of dragging slow traffic around curves that have been elevated for high speeds.

Since the motive power which hauls these high-speed trains is without reciprocating parts or is counterbalanced to conform to the speed, and since most of the high-speed trains are also light-weight trains, their effect on properly maintained track will be no more adverse than that of the slower trains. On the other hand, there has been a coincident speeding up of other trains which are being hauled by reciprocating locomotives which are not counterbalanced for their new speeds, with consequent danger to both track and structures. A safe rule to apply to this power is not to allow the speed in miles per hour at which it is operated to be greater than the diameter in inches of its driving wheels. Wherever power is not properly counterbalanced for its speed it is certain to create damage. This is particularly true for freight locomotives, for many of them are being operated at speeds far in excess of those for which they were designed.

Trains that may attain speeds up to 100 or more miles an hour require high-speed track, for no train can be expected to ride better than its track. Track laid with light rail will soon get rough as a result of oscillation and impact of the wheels, and must be replaced with heavy sections. Rail lighter than 112 lb. calls for careful patrolling, to insure that dangerous defects do not develop, for small defects are likely to develop rapidly into larger ones under high-speed traffic.

Have Marked Effect

By I. H. Schram
Engineer Maintenance of Way, Erie, New York

Speeds for both freight and passenger trains have increased to a marked degree in recent years, making it necessary to adjust the elevation on curves, lengthen spirals, smooth bridge approaches, change interlocking plants where detours are made and take similar action in other cases. They have necessitated studies of drainage to the end that slow orders may be abolished and track be kept safe without excessive labor at points where slow orders were formerly common during bad weather. These higher speeds have made it necessary to develop methods of strengthening and renewing bridges, so that slow orders will be less restrictive than formerly while work is being done, and to reduce the time required to do the work.

A careful study of the conditions under which work must be done and the application of proper corrective

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in June

1. What precautions should be observed when renewing ties to prevent injury to trackmen?

2. For what purposes can power equipment and tools be used to advantage in the construction and maintenance of buildings?

3. When rail on curves becomes worn, is it more economical to transpose it or to lay new rail? Why? What considerations govern this?

4. What information is necessary to permit the preframing of ties, guard timbers, stringers and caps for use in replacement? How is this information obtained and how presented to the framing gang?

5. To what extent is the application of anti-creepers warranted on yard tracks? Why?

6. What are the causes of pounding in a pump? How can it be prevented?

7. What considerations justify the elimination of weeds? What is the importance of each?

8. Can the exterior of a stucco building be painted? If so, how? Is this advisable? Why? What precautions must be observed?

measures will make it practicable to keep the increased costs of maintenance which result from these shortened schedules, within reasonable limits. For example, as the speed increases, a change in the amount of rail wear on sharp curves becomes apparent, and adjustments of elevation—often increased elevation, longer spirals and the use of rail and flange lubricators will reduce the rate of wear to a reasonable amount. Care must be taken, however, to select an elevation that will permit proper adjustment of the wear between the high and low rails. This is somewhat easier to do than formerly, because most freight trains are now running at speeds that approximate those of the fastest passenger trains only a few years ago.

While drainage has always been the basis for most good track in former years, high elevation on curves greatly increases its importance, for irregularities in elevation are more dangerous than where both speed and superelevation are lower. Good drainage also tends to promote good ballast conditions and the maintenance of good cross level. Drainage at highway crossings also assumes a new importance, since retained water soon means rough track. Maintenance of a ballast section strong enough to hold the track in line and cross level is essential under high-speed operation.

Types of motive power and the class of traffic have an important bearing on track maintenance under high-speeds. It seems to be the consensus of opinion that high-speed freight trains do more damage to the track than high-speed passenger trains. Much freight power is not designed for the highest speeds and it has been the experience that track is moved out of line by such power. Great care must be exercised to keep the track in adjustment, particularly on spirals, at the ends of bridges and elsewhere where bad line is most likely to be felt. As locomotive design becomes more suitable for these speeds and ballast sections are improved, this difficulty will doubtless decrease.

The types of cars and wheel loads have a similar effect when heavy axle loads are encountered. Heavy commodities such as steel and coal, when handled at high speed, increase the difficulties of keeping track in line, surface and gage. As heavier rail sections are employed and drainage is improved, all of these difficulties tend to smooth themselves out, but the fact remains that with higher speeds greater vigilance is required and small defects must be remedied promptly before they grow into large ones. Cross level, line and gage must be maintained to a higher degree of perfection, and advantage must be taken of every opportunity to strengthen and improve the track structure. Signal systems need to be given similar study, and corrections need to be made in signal interlocking and switch-stand connections, and other related matters.

Surfacing Wood Platforms

Is there any advantage in surfacing wood platforms with bituminous materials? If so, what? How and when should they be applied?

Has Several Advantages

By Frank R. Judd
Engineer of Buildings, Illinois Central, Chicago

There are a number of advantages to be derived from surfacing wood platforms with bituminous materials. These materials may be in the form of asphalt mixed with sand or other fine aggregate, depending on the class of traffic to be served, or they may be incorporated in a specially prepared plank. For making repairs where the wood deck is badly worn but structurally sound, a desirable and durable surface can be obtained by applying the bituminous surface directly to the deck. This method is very practical for small inequalities are readily eliminated and a smooth surface is provided for both pedestrians and trucks without the necessity of assuming the cost of renewing the deck.

Where trucking is heavy, the bituminous material may be reinforced with a metal grillage, which will take practically all of the wear. There are a number of different kinds of grillage on the market, which are used extensively for this purpose, and which are easy to handle and to lay.

In the case of new wood decks on platforms, bituminous surfacing may be employed primarily to permit the use of wood construction, for while the wood is strong enough it lacks the wear-resisting qualities which should characterize a good platform deck. In such cases, a good wearing surface can be obtained by mopping the plank with mastic and sprinkling sand over it, preferably while still hot. This surface will protect the plank by taking all of the wear, but, obviously, the process must be repeated from time to time, depending on the amount of traffic passing over the platform.

When this method is used the planks must be laid with tight joints to prevent the mastic working through. Asphalt planks are used widely as a wearing surface for new wood platform decks, and give excellent results. This material is not so desirable for resurfacing old platforms, however, for it requires a good smooth surface below to insure a smooth exposed or wearing surface. It is made under heavy pressure and will withstand heavier loads than the bulk material mixed on the job and applied.

Bituminous surfaces are practically noiseless, smooth, easy to keep clean, while in most instances minor depressions and cracks are ironed out or sealed by the traffic when the weather is not too cold. This material should be applied during warm weather to simplify and keep down the cost of placing. Application can be made successfully during cold weather, but the materials other than bituminous plank will require heating.

There are many different makes of bituminous materials from which one can select for the particular application under consideration. To obtain the best results the manufacturer's recommendations should be followed closely, particularly with respect to laying the material. In all cases, however, all corners and edges should be protected with wood or metal edging strips, to eliminate the probability that they will break down and disintegrate under traffic.

Does Not Favor

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

To surface a wood platform with bituminous material necessitates that the deck be in good condition structurally and that it be capable of bearing the traffic which must pass over it. One cannot just take any platform and surface it with bituminous materials and expect to be successful. The platform deck boards must be laid tight to prevent the mastic from flowing down into the cracks, while border strips must be placed around the edges to keep the material from breaking here and eventually going to

pieces. Much better results will be obtained if the deck boards are shiplap or center matched.

We have had some experience in applying bituminous materials over wood-plank street crossings, but they failed to give satisfactory service, primarily because of vibration and the difficulty encountered in protecting the edges. We have also had considerable experience in applying material of this type over brick platforms for the purpose of providing a smooth surface. These applications have been quite satisfactory. From my own experience, I do not consider that it is economical to apply bituminous surfaces to wood platforms.

If a bituminous surface is to be applied, this should be done during the spring or fall and when the temperature is not less than 40 deg. Good results cannot be insured if the application is made during cold weather, for the relatively thin layer of surfacing material stiffens so quickly when it comes into contact with the cold surface of the platform that it becomes extremely difficult, if not impracticable to do a workmanlike job. On the other hand, in extremely hot weather the mixture is likely to remain soft too long and thus interfere with the use of the platform.

Mastic for surfacing a platform should be mixed with the small aggregate in a machine similar to a concrete mixer and applied while it is still at a workable temperature so that it can be handled with shovels and laid from 1 to 1½ in. thick over the surface to be treated.

Prevention of Soft Spots

What practical measures can be taken to prevent the formation of soft spots in cuts? In embankments?

Grade and Drain

By L. L. Adams
Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

Any practical measures to prevent soft spots in roadbed must generally be taken at the time the roadbed is constructed. In the construction of cuts the points to be observed are: (a) leave no pockets in the subgrade that are not adequately drained; (b) low points in rock cuts must be filled with rock, not with earth; (c) the roadbed should be properly graded and well drained; and, (d) sufficient ballast of suitable character must be used to distribute the traffic load thoroughly and evenly.

In constructing fills, only suitable material should be used, and it should be placed in such manner as to secure the maximum amount of stability. It is often the practice to use material from cuts for the construction of fills, regardless of its suitability. At times it will be economical to waste the material from cuts and borrow material that is more suitable for the construction of the fills. Rocks taken from a cut must not be placed on top of a fill that has been constructed partly with earth as, in most cases, this will result in the formation of water pockets.

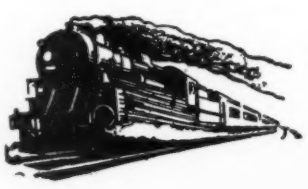
Summarizing, the construction of fills should include (a) the selection of suitable material; (b) the proper placing of the material in the fill; (c) provision for cross drainage at the ends of cuts where water has a tendency to run through the cut into the fill; and (d) sufficient ballast of the right kind to give a satisfactory distribution of the track loads over the fill.

After the roadbed has been constructed, it is important that it be well maintained, so as not to permit standing water to soak into the roadbed. Ballast should be added from time to time in sufficient quantity to keep the right amount of effective ballast under the ties at all times to permit the water to drain to the edge of the ballast, instead of soaking into the roadbed.

A Construction Problem

By Armstrong Chinn
Chief Engineer, Alton, Chicago

Prevention of the formation of soft spots is essentially a construction problem, as the time to take preventive measures is when the line is being built. These measures include good drainage, particularly in cuts, suitable material of a porous nature for fills, a proper crown on the roadbed so that it will shed water, sub-ballast of sufficient depth to help distribute the traffic load to the roadbed, an adequate ballast section, clean ballast and correct tie spacing.



No one can say beforehand, with any degree of certainty, where, or if, soft spots may form. Once the track is laid no road is going to do anything about them unless they develop to the point where they give trouble. If that happens, such action as seems desirable should be taken to cure them. On most roads the construction of new lines is now largely a thing of the past. For this reason, the problem today is rather that of curing soft spots that have been developed by the greater impacts of the heavier loads and higher speeds of modern traffic, than of preventing their formation.

Soft spots can be cured in several ways, such as draining them with tile, pipes or French drains; by supporting the roadbed with piles or timbers driven on one or both sides of the track; by floating the track and ballast section on a deck of timbers or concrete slabs laid on the roadbed; or by a combination of these methods, such as French drains that provide both support and drainage.

Soft spots in cuts are usually cured by either installing drainage or supporting the roadbed. As a rule, drainage is secured by laying a tile or a corrugated pipe under one or both side ditches from the soft spot to the end of the cut, deep enough to permit lateral drains to tap and draw the water from their lowest points. Supporting the roadbed is usually accomplished by driving a line of timbers, often old ties, along one or both sides of the track as required. This will not only provide support for the track, but will sometimes open up pervious material under the track and aid drainage. Occasionally, a deep ditch dug along one side of the track and filled with stone of riprap size, will both give the necessary support and provide drainage.

Soft spots in fills have been cured by installing pipe drainage systems; by supporting the fill with piles or timbers driven on both sides of the track and tied together with wire cables under the track; by floating the track on a grillage of timbers or a concrete slab laid on the roadbed under the ballast; or by replacing whole sections of the fill with more suitable material, such as cinders or gravel. However, for the usual condition that is not too aggravated, the cheapest method is to place a deep, heavy French drain opposite each soft spot to provide both support and drainage.

The trench in the fill and foundation hole in the natural ground can be dug quickly and cheaply with a clamshell, and one-man riprap makes excellent back filling material. No matter which method is followed, the curing of soft spots is expensive, but as this reduces maintenance costs, eliminates slow orders and increases safety, the cost is usually more than justified.

Pumps for Foundation Work

What type of pump is best suited for use in foundation cofferdams? Why? If centrifugal pumps are used, should they be belt-driven or connected directly to the power unit?

Prefers Centrifugal Pumps

By Supervisor of Bridges and Buildings

In general, the amount of water is the deciding factor in selecting a pump for draining a cofferdam, although a number of other factors may be of importance, such as power supply and the character of the water to be handled. Where only a small amount of water is encountered, the steam siphon is probably the most satisfactory, especially if the water is muddy and has considerable sand in it, since there are no moving parts to this equipment. The only serious disadvantage it possesses for this service is that the amount of water it will handle is somewhat limited and it is quite wasteful of steam.

If electric power cannot be obtained, it may be necessary to use a steam pump, but this should be avoided if practicable because pumps of this type require substantial supports that may be difficult to provide under the conditions that usually obtain in a cofferdam. I prefer the belt-connected centrifugal pump for draining cofferdams, since they are flexible in operation, much lighter than other types and occupy less space. The fact that the water may be muddy and full of sand does not affect their operation. The direct-connected centrifugal pump can be used under favorable conditions, but it requires a much more rigid support, since the vibration when the motor or engine is running at full load may cause trouble unless the support is solid and stable.

Depends on Conditions

By General Bridge Inspector

In selecting a pump for keeping cofferdams clear of water, one must give consideration to a number of factors, including the size of the cofferdam, its depth, the volume of water to be handled, the character of the material comprising the foundation, the clearance that will be available between the cofferdam and the masonry, whether more than one pump will be required and whether electric power is available. Whatever type of pump may be selected, the capacity should not be figured too closely, since there should be sufficient reserve to care for emergencies. On the other hand, a pump that is greatly oversize may be as much of an embarrassment as one that is too small. It is better in most cases to have a pump of such capacity that it can be operated continuously than to have one of so much greater capacity that it can be kept running only intermittently. In other words, a 6-in. pump may be as unsuited for a cofferdam that can be kept dry with a 2-in. pump as the 2-in. pump would be where one with a 6-in. discharge is required.

In general, the centrifugal pump is best adapted for large cofferdams, particularly where large volumes of water must be handled. An especial advantage of the centrifugal pump in this service is that it will function satisfactorily where the water contains sand or mud, a condition that is quite common in the drainage of cofferdams. Personally, I prefer the vertical belt-driven type with an extensible shaft and adjustable pulley. Such a unit requires very little room, it is easy to handle and it can be raised or lowered at will as the work demands.

If power current is available an electric motor is the most desirable power unit, but this is rarely practicable for the larger pumps, although pumps up to 2 in. can be operated from portable generators. Gasoline engines can be used to drive the belt pulley, but they are objectionable because of the noise. Steam pumps are likewise objectionable because of the steam exhaust as well as the noise, while a much more substantial support is required than for a centrifugal pump. Again the pipe fitting connected with the installation of a steam pump is an obstacle to its use in many cases.

If only a small quantity of water is to be handled, no more satisfactory means of disposal can be found than the steam siphon or ejector, as it is usually called. The installation is quite simple, there are no moving parts to be clogged or damaged by sand in the water and the ejector is always ready for instant use, so that it can be shut off and started at will.

Taking Rail Temperatures

What is the best method of insuring accuracy in obtaining the temperature of rail as it is being laid?

Apply to Head of Rail

By P. O. Ferris
Assistant Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

To obtain accurately the temperature of rail as it is being laid, an accurate rail thermometer should be applied to the head of the rail adjacent to the joint and left in contact with the rail long enough to insure that the reading is the temperature of the rail at the point applied. In taking these readings the thermometer must be protected from the direct rays of the sun. As most tables of recommended joint openings are based on a temperature range of 25 deg., F., readings with a rail thermometer should be made frequently enough to record all changes of 25 deg., especially between temperatures of zero and 100 deg., F., so that proper expansion shims will be used.

Keep Thermometer Shaded

By W. L. Roller
Division Engineer, Chesapeake & Ohio, Columbus, Ohio

Rail temperatures should be taken with the rail thermometer applied directly to the rail on its shaded side, that is out of the direct sunlight, instead of depending on atmospheric temperature. Readings should be taken at intervals throughout the length of several rails to arrive at an average temperature. Experience has

shown that it is good practice when preparing to lay rail on double track, to unload the rail between the tracks with the rail set to workways. This promotes free circulation of air around the rails, insures uniform rail temperatures and makes the checking of the temperature of the rails much easier.

There is invariably a marked disparity between the temperature of the rail and that of the atmosphere, for which reason accuracy demands that the temperature of the rail itself be ascertained as nearly as possible by applying the thermometer directly to the rail, and for the same reason care should be exercised to shield the thermometer from the direct rays of the sun. By taking readings on several rails and arriving at an average temperature, compensation can be made for local variations, such as shade, wind, etc. Likewise by checking the temperature at stated periods during the day, allowance will be made for corrections made necessary by atmospheric changes.

Recently, there has been a tendency to ignore temperature in providing expansion, especially in the medium ranges, and particularly when laying the heavier sections. However, in laying rail with more or less inadequate facilities for anchorage, it is still highly important that adequate and uniform expansion be provided in the extremely low and extremely high temperatures.

Cover Thermometer

By Bernard F. McDermott
Roadmaster's Clerk, Chicago & North Western, Redfield, S. D.

To insure accuracy in obtaining the temperature of rail as it is being laid, one should use a standard track-laying thermometer which is designed specifically for taking rail temperatures. It has a bulb that is in the form of a flattened tube about 1 in. long, instead of the usual ball-shape. This long, flat bulb is mounted in such a manner that a large surface will rest in direct contact with the rail upon which it is placed. This insures that the thermometer will respond to the temperature of the rail promptly and certainly. As precaution against outside influences the thermometer should be covered with a pad or shield which can be lapped over both it and the rail to shut off air currents. This is done to obtain the absolute temperature of the rail and not of that of the air.

Again, the thermometer should be placed with the bulb against a rail that is about the average of the next dozen or so that are to be laid. It should remain in place until there is no further change in reading. Readings should not be taken on a rail that is in the shade, if others that are to be laid immediately are exposed to the sun.

The foreman in charge of the rail gang should appoint one man to take the temperature readings and be responsible for seeing that the correct expansion shims are used. This man should be trained to take the temperature readings correctly, and he should keep the gang supplied with shims of the right thickness and check their use. He should take the temperature frequently enough to change the shims as changes occur in the rail temperatures. He should keep a set of notes in which he records weather conditions, temperature changes, shim thickness and mile post references at stated intervals during the day.

Shortening Eye Bars in Trusses

Is it practical to shorten loose eye bars in a truss span by heating them? If so, how should this be done? If not, how can they be shortened?

It Is Practical

By G. A. Haggander
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

It is our experience that the shortening of eye bars by the method suggested in the question is practical for bars up to a cross-sectional area of about 4 in. by 7/8 in. We have many light truss spans, some of which have been re-erected, in which the eye bars are not in proper adjustment. For many years we had in our employ a man who spent a great deal of time doing this work, and it was successful because of his experience and good judgment. When he retired we discontinued the practice because we feared that some inexperienced man might damage the bars.

The method consisted of clamping steel blocks to the eye bars that were to be shortened, spacing them about 5 ft. apart. Holes were left on each side of these clamped blocks through which 1½-in. steel rods were placed. The eye bar could then be shortened after it was properly heated, by taking up on the nuts on these rods.

For the heating operation a steel fire box, which would heat about 1 ft. of the length of the eye bar, was placed around the bar about midway between the clamping blocks. This was filled with charcoal and was connected to a blower fan. In this way the eye bar was heated to the proper temperature, the nuts were taken up the required amount, the firebox was taken off, and the kink was taken out of the bar with mauls and flatters. It required a great deal of experience to determine just how much the bars should be shortened to bring them to proper adjustment, but in general, the work, as it was carried out, was successful.

At present, these light eye bars are being adjusted by wedging timber blocks between them to produce the proper tension, and bolting the blocks in place. For large eye bars which have been badly bent or otherwise damaged, or which require shortening, modern practice calls for cutting the bars and installing turnbuckles which are riveted or welded to the remaining portion of the bars. By proper welding procedure, this method of shortening can be accomplished without any reduction in the strength of the bar.

Requires Experience

By Bridge Engineer

We have a number of pin truss spans, which developed loose eye bars in the web members after many years of service. In the past, some loose bars had been cut and large turnbuckles had been installed by riveting, but this was somewhat expensive and reduced the section of the bars. Since the erection foremen were experienced in shrinking bars, equipment was obtained for this purpose, consisting of clamps, rods and a small furnace, and this work is now being done whenever a structural steel gang finds a bar loose enough to warrant attention.

In the prosecution of the work the clamps are placed on the bar from 4 to 6 ft. apart. The small furnace is placed on the bar, and pulling bolts are set through the clamps. The furnace is then filled with charcoal, an air hose is attached to provide the air for combustion, and the bar is heated slowly. Before heating, two points a definite distance apart are center punched on the bar and a stick with steel points which are the same distance apart, is used in judging the

amount that the bar lengthens as it is heated, and how much the bar is shortened by the pull of the clamp rods.

Obviously, experience in knowing just how far back to pull the heated bar is an essential requirement, but even then it is sometimes necessary to make a second pull. There is always the chance that the bar will be forced out of line, and this feature must be watched carefully. The shortened bar is allowed to cool slowly, the work being timed so that there will be several hours between trains.

Our experience is that all shortened bars do not stay tight, since wind and vibration cause wear on the pin. We have helped this situation, however, by welding plate diaphragms between the bars, or small angles diagonally from bar to bar, as a result of which the vibration and movement from wind action are greatly lessened, if not eliminated.

We have adjusted bars by cutting and installing turnbuckles as already noted, but as yet we have not done this on main-line bridges. This is a very satisfactory method, however, and I believe that it is followed universally where erection foremen do not have the experience necessary to qualify them for shrinking bars.

Replacing Posts in Tank Frames

How does one go about replacing a post in the frame of a wooden tank?

Frame the Timbers First

By Andrew Finnes
Master Carpenter, Great Northern, Minot, N. D.

The practice most commonly followed is first to frame the new post to conform to the old one, then set a jack beside it, with an 8-in. by 8-in. strut on top of the jack to reach to the cap upon which the tub rests. Next remove all braces attached to the post to be removed, raise the cap with the jack to release the post, insert the new post, replace the braces and release the jack.

If all of the posts in the tower require renewal, the same method should be followed, except that two posts can usually be released if two jacks are used at each setting, this operation being repeated until all of the posts have been replaced. The amount of water in the tank should be reduced to the minimum necessary to take care of traffic while the posts are being replaced.

Precautions Necessary

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Obviously any consideration of this question must take into account the importance of an uninterrupted supply of water, for which reason the structure must be maintained in safe condition and with ample water to care for all requirements while the posts are in the process of being renewed or other incidental heavy repairs being made. It is our practice to place firm temporary foundations capable of supporting the full load, next to the posts that are to be renewed. A temporary post should then be placed on the top of a jack that has ample capacity to raise the load, this post being braced securely to insure against side movement, and thus prevent its kicking out.

Precaution should be exercised to avoid raising the tank more than is necessary to give the required clearance, to avoid shifting the water in the tank, as this may cause a surge which will create danger of the tank collapsing. Only one post should be detached from the braces and removed at one time. In other words, after a post has been replaced it should be well braced before work is started on another. Many tank failures have occurred as a result of removing too many posts at one time, of raising the tank too high, of failure to have the temporary jacking post braced properly, of using a temporary post of insufficient size to carry the load or of failure to provide a fully stable footing for the jack. The replacement of a post in a wood-tank frame is a simple problem if the right methods are used and necessary precautions taken.

Tanks Are Top Heavy

By W. A. Harmon
Supervisor Bridges and Buildings, Southern Pacific, San Francisco, Cal.

There is no difference in the procedure of placing a post in a tank frame and in any other loaded structure, except that greater care must be exercised in supporting the load. Tanks supported on towers are obviously top heavy when full of water and care must always be exercised when working in the tower to insure that the equilibrium of the structure is not disturbed to any great extent.

Furthermore, wood tanks, being made of a great many individual pieces which are held together by dowels and metal bands, must not be disturbed by throwing the floor system out of its true plane or the tank may develop leaks that will be difficult to repair. For this reason, it is not advisable to raise the floor system at any one point much higher than its true plane.

If the post to be replaced sets into a cap or base casting, it is preferable to cut down the pier sufficiently to slip the post into position with the base and cap castings in place, to avoid raising the floor system. Some base and cap castings are so designed that the post can be replaced with only enough raise to clear it.

Where corner posts are replaced, it will be necessary to use two jacks, but only one jack is needed for interior posts. All preliminary work of loosening braces should be done first; then the amount of water in the tank should be reduced to the safe minimum to lower the center of gravity of the tank. The strain on the jacks should be only enough to keep the caps at the proper level, and only enough of a raise should be made to allow the posts to enter sidewise freely. It is very easy to injure a wood tank by improper treatment when it is loaded.

Deterioration Not Uniform

By J. P. Hanley
Water Service Inspector, Illinois Central, Chicago

In the older wooden tanks, where untreated timber was used, the replacement of various members in the frame usually involves considerable expense. The frame consists of posts, caps, X-braces, main joists on the caps and, in some of the older tanks, floor joists above the main joists. The deterioration of the several members is not uniform, and it is usually economical to replace the more rapidly decaying parts while the remaining parts continue to serve.

However, in replacing a seriously deteriorated member, consideration should be given to the condition of the entire frame, and if the useful life of other parts is estimated to be relatively short, all parts that will need renewal within a reasonably short time should be attended to when the

seriously deteriorated member is replaced. This will reduce the frequency and expense of raising the tank for replacement of single parts and prevent unnecessary rocking of the tank.

In general, the procedure followed in replacing a post is to install stiff-legs or vertical timbers between the caps and the ground, upon a substantial block foundation. Hydraulic or screw jacks are placed on the blocks and under the bottom end of the beam and the tank is raised until there is sufficient clearance to remove the old post and install the new one. If several posts need replacement, additional beams and jacks may be used to advantage. It is usually advisable to reduce the water level in the tank by means of the float valve or by instructions to the pumper to prevent unnecessary weight on the jacks.

Replacement of caps, main and floor joists is usually handled in the same manner. However, replacement of the floor joists directly below the tank floor is more difficult than that of other parts, because it becomes necessary to apply enough lifting pressure directly to the tank floor to secure sufficient clearance to apply the new floor joists between the main joists and the tank chime. In this case it is advisable to reduce the water level and weight to the minimum, and to provide substantial bearing timbers on top of the stiff-legs to prevent the puncturing of the tank bottom, which is usually beginning to get soft by the time it becomes necessary to replace the floor joists.

Inspecting Ties After Removal

Is there any advantage in making an inspection of ties after they have been taken out of the track? Why? Who should make the inspection? What record should be kept? How can it be used?

A Decided Advantage

By Armstrong Chinn
Chief Engineer, Alton, Chicago

There is a decided advantage in inspecting ties after removal. The only way one can know with any degree of accuracy whether ties are being removed in accordance with the prevailing standard is to inspect them after removal. Ties represent one of the heaviest items of expense in maintenance and anything that can be done to hold this expense down and still provide the desired standard of maintenance is well justified.

No two men think exactly alike, for which reason it is difficult to have all foremen renew ties to the same standard unless someone inspects them as they are removed and sees that none come out that should have remained in the track. When foremen know that this will be done, they will be more careful to adhere to the desired standard.

The supervisor, being in direct charge of the foremen, should inspect the ties that are removed. He is primarily responsible for the condition of the track and for maintaining it economically, and should, therefore, be responsible for tie renewals. However, the division engineer should accompany him often enough to know that he is following the proper standard. An occasional inspection by the engineer maintenance of way will be helpful in keeping every one alert to the importance of proper tie renewals, and this will be reflected in tie costs. The purpose of such inspections is to teach the foremen the standard they are to follow and to see that they do not take out ties that should be left in. This can be accomplished best by looking at the ties and not by keeping records. In other words, records will be of little value after the ties have been removed.

Several Factors Involved

By A. E. Perlman
Engineer Maintenance of Way, Denver & Rio Grande Western, Denver, Colo.

Whether an inspection of ties is necessary after they have been removed from the track, depends on several factors. If an adequate number of test sections are maintained on the road, where a rigid inspection is made of every tie removed for whatever cause, from a specified length of track, sufficient information is derived to allow the management to make decisions covering the most satisfactory species of wood and types of treatment to be used in the various localities on the road.

If ties are properly inspected and marked before they are allowed to be taken out, little benefit will be derived from an inspection after they have been removed, since, even if one or two years of additional life is found to remain in any tie, the expense of replacing it in the track will be far greater than the value of the tie thus reclaimed.

Inspection Promotes Uniformity

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

Our rules require that both cross and switch ties must be piled adjacent to the track and not destroyed until they have been carefully inspected by the roadmaster. Ties fit for further use are culled and piled at right angles to the track; those unfit for use, except as fuel, are piled parallel to the track.

To the end that each roadmaster or supervisor will have a uniform understanding that there will be a uniform practice among his foremen with respect to tie renewals, it is well that he go over tie renewals with each foreman before the renewals are made. After the ties have been removed and piled, a further inspection should be made to determine their exact condition. Not infrequently ties that have been marked for renewal in main tracks will be found after removal to contain sufficient service life to warrant their reuse in less important tracks.

We have certain defined limits or locations that are designated as test sections, on which records are kept by the tie and timber department, to indicate the exact performance of the various kinds of wood and the different treatments that are being used. Such a record should suffice for all practical purposes. Since the men representing this department are interested in and charged with the responsibility of placing the best material available in the hands of the maintenance forces, they are likewise better qualified to make the analysis of the tie situation. For these reasons any records that are kept should be handled by this department.

Except on test sections, unless records are kept covering the entire tie renewals on the system or by divisions, I cannot see that the expense of a dating nail to indicate the insertion date, is of any value. On roads that do not operate their own treating plants but buy their ties in the open market, it would be well to have an inspector, working independently of the maintenance organization, cover the entire territory and keep such records as may be necessary to insure receiving ties that will give the maximum of service.

What Our Readers Think

Gum Ties

Dallas, Tex.

TO THE EDITOR:

Some time ago you published a discussion on the merits of gum ties. Having this in mind, I was very much interested during a recent trip over the line to observe a number of gum ties with 1909 dating nails in them. Their service life was about exhausted, however, and they will have to come out in the next year or two. I also noticed a number of others that had been inserted in 1911.

I was unable to identify the particular species of gum, but records indicate that they had been treated to a 5-lb. retention with Grade 1 creosote. All of these ties are in heavy-traffic main tracks, and substantiate the opinion held by some of us that gum wood makes good ties if care is exercised in their selection, handling, seasoning and treatment.

K. H. HANGER,
Engineer Maintenance of Way,
Missouri-Kansas-Texas

Why Gage Is 4 Ft. 8½ In.

Chicago, Ill.

TO THE EDITOR:

Recently, to prepare a response to an inquiry from one of our superintendents, I consulted various authorities as to why 4 ft. 8½ in. is standard gage for railway track. I found the investigation most interesting and, incidentally, I learned much of the details concerning the history of gage practices that I had not known before. I believe that the information I obtained will be of as much interest to other engineers as it was to me. Briefly, the story is this:

When the Stockton & Darlington railway in England, which was opened for traffic in 1825, was being planned, the eminent engineer, George Stephenson, who built it, and the proprietors of the railway discussed at some length the subject of the gage of the track. Finally, the question was settled "with reference to the probable interchange of rolling stock and the gage of existing roads, which was 4 ft. 8½ in."

Since the treads of existing wheeled vehicles at that time were practically this gage, and it was contemplated that their use, with modifications, would be continued, it was recognized that by the adoption of this gage extensive alteration of existing vehicles would not be necessary. It will be seen, therefore, that no technical questions were involved in determining the width of gage; it was simply a matter of adapting new construction to existing conditions.

In the early years of railway development in the United States, "English standards dominated the policies of American construction" (Dunbar's History of Travel in America. 1915), and since the 4 ft. 8½ in. gage was the standard for English railways, it was but natural that this width should be transplanted to this country. American engineers were individualists, however, and were called upon to meet a wide variety of conditions, many of which had not confronted their English cousins. The result was that there was little adherence to this standard during the early years of railway development in the United States. In fact, Ashcroft, in his Railway Directory, published in 1867, states that at that date, "on 30 different roads comprising 4,695 miles of line there were no less than 12 different widths of gage, ranging from 4 ft. 3 in. to 6 ft."

It was not until the Pacific road (the Union Pacific and the Central Pacific) was built from Council Bluffs, Iowa, to San Francisco, Cal., that the question of gage was settled definitely and 4 ft. 8½ in. was made the standard gage, although it took an act of congress to do so. Dunbar's History of Travel in America devotes several pages to the controversy over this matter, which can be summarized as follows:

It will be recalled that the building of this line was a federal project. By an act of congress, passed in 1862, the duty of establishing the gage to which this road should be built devolved upon the president, Abraham Lincoln. Strange as it may seem to us now, 75 years later, severe political pressure was brought upon him in behalf of the several gages then in use. The fight between the advocates of the various gages became so hot eventually that Lincoln actually called a cabinet meeting to consider the question. After this meeting he sought to quiet the controversy by issuing a proclamation that the road should be built to a gage of 5 ft.

Instead of quieting, it merely stirred the proponents of the remaining gage widths to greater activity. They refused to accept the president's ruling and the quarrel was transferred to congress. It did not matter that both congress and the president had a civil war on their hands, the question of gage had to be given further consideration. Finally, after eight months of active contention, a law was passed, in March, 1863, "naming 4 ft. 8½ in. as the gage for the Pacific Road." This action, more than any other event in American railway history, was the determining factor in establishing the prevailing and so-called standard gage for the railways of the United States.

Immediately after this law was passed, many of the roads which had not been built to this gage saw the necessity of conforming to the width thus decided upon, if they expected to participate directly in transcontinental traffic. The necessary physical transformation began almost at once and continued until the declared standard became practically universal throughout the United States.

In this connection it is interesting to note that there were three important track gages—narrow, standard and broad—variously advocated by engineers and others interested in railway construction and operation. The advocates of narrow gage argued that this gage insured the most economical cost of construction, a matter of no small importance for a pioneer road which must await the settlement of the country through which it was built, to develop its traffic.

On the other hand, the proponents of standard gage contended that an effective national system of transportation was the crying need of the country, and that this objective could be attained only through universal adoption of a standard gage which would permit free interchange of traffic. Those who favored wide gage did so on the ground of safety. They asserted that standard and narrow gages were unsafe for operation except at unreasonably low speeds and that wide gage was necessary for safety at the higher speeds.

These view points were irreconcilable. It required time, experience and an unprejudiced study of all of the factors involved to bring these various interests into accord. So tenacious of their opinions were the advocates of the respective gages, however, that despite the acute problems connected with the interchange of traffic that were created by variations in gage, and the obvious advantages of standardizing gage, it apparently required an act of congress to accomplish what individual carriers could not or would not themselves undertake for their common good.

A. W. NEWTON,
Consulting Engineer, Chicago,
Burlington & Quincy

New Books

Story of Bridges

THE STORY of Bridges, by Archibald Black. 6 in. by 9 in., 226 pages. Bound in cloth. Published by Whittlesey House, McGraw-Hill Book Company, Inc., 330 West 42nd street, New York. Price $2.50.

The object of this book is to give the lay reader some conception of the problems that are encountered in bridge building and how they have been solved. It also endeavors to present a brief history of bridge engineering and, insofar as the last century is concerned, it gives particular attention to the constant increase in the lengths of spans, culminating in the 4000-ft. span of the Golden Gate bridge. The author makes acknowledgment to several bridge engineers for checking the text, and he should be commended for its accuracy, but it is doubtful if all of his readers will gain a clear understanding of some of the processes described, for example, foundation methods. There is considerable ground for the criticism that the author has given undue prominence to a few bridge engineers of note and has given little space to, or has failed to mention, others of equal or greater merit. To the man whose work brings him in direct contact with bridges, the book offers a pleasing means of refreshing his memory concerning the salient features of the world's great bridges.

Bridge and Building Proceedings

PROCEEDINGS of the American Railway Bridge and Building Association, 44th annual convention. 200 pages, illustrated, 6 in. by 9 in. Bound in cloth. Published by the association, C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Price $2.

This volume contains the Proceedings of the convention held in Chicago on October 19-21, 1937. The Proceedings of this association present a most complete picture of trends during the last half century in current practices in the maintenance of railway bridges, buildings and water service facilities. Like its companion organization, the Roadmasters' Association, its view point is that of the division officer in direct charge of field forces and its deliberations in reports, papers and discussions are intensely practical. The current volume is no exception.

This volume contains reports of committees on Rebuilding Our Bridge and Building Organization to Meet the Demands of the Present Day; Taking Up the Deferred Maintenance in Painting; The Insulation of Railway Buildings; Protecting Men Against Accident in the Use of Power Tools; Meeting Today's Demands for Water Service; Recent Developments in the Construction of Timber Trestles; The Maintenance of Movable Bridges; and Practical Measures for the Protection of Bridges and Buildings Against Fire. It also contains addresses by S. H. Osborne, assistant to president, Union Pacific System, on Why Bridge and Building Men Are Injured; and by C. E. Smith, vice-president-purchases, New York, New Haven & Hartford, on Our Relationship with the Purchasing and Stores Department. This volume is edited to the same high standards that have long characterized the proceedings of this association.

Roadmasters' Proceedings

PROCEEDINGS of the Roadmasters' and Maintenance of Way Association of America, Fifty-second Annual Convention. 166 pages. Illustrated. 7 in. by 10 in. Bound in cloth. Published by the Association. C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Price $2.

This volume contains the proceedings of the convention held in Chicago on September 14-16, 1937. As in preceding years, this volume of the proceedings of this pioneer maintenance of way association contains a vast fund of practical information on current problems of track construction and repair, in reports, papers and discussions from the floor. The conventions of this association are noteworthy especially because of the extent and frankness of the discussions, a fact that has contributed materially to the increased attendance of engineering as well as track maintenance officers in recent years.

This volume of proceedings contains the reports of committees, with discussion thereon, on Good Practice in the Laying of Rail to Secure Workmanlike Results; The Trackman's Responsibility for the Safety of Highway Crossings; The Housing of Track Labor; The Operation of Motor Cars to Avoid Accidents; and The Maintenance of Rail Joints. It also contains addresses on The Relationship Between the Stores and Maintenance of Way Departments, by W. S. Morehead, general storekeeper, Illinois Central System; on The Curing of Soft Roadbed, by A. A. Miller, engineer maintenance of way, Missouri Pacific; and on Building Track for Today's Traffic, by H. S. Clarke, engineer maintenance of way of the Delaware & Hudson.

Wood Preservation

WOOD PRESERVATION, by George M. Hunt, in charge, section of wood preservation, United States Forest Products Laboratory, and George A. Garratt, associate professor of forest products, Yale School of Forestry. 457 pages, 6 in. by 9 in. Bound in cloth. Published by McGraw-Hill Book Company, Inc., 1330 West 42nd street, New York. Price $5.

According to the Preface, this book was written to serve as a text book and as a reference work that would prove of value to users of wood as well as to men in the timber treatment industry, and the authors have succeeded in compacting a large amount of valuable information into 457 pages. Considering the enormous amount of data at their disposal, the judgment that they have exercised in determining what to include and what to omit should accord with that of most readers who have a working knowledge in this field.

The authors have devoted about an equal amount of space to the practical considerations, such as plant equipment and methods, proper storage and preparation, the use of anti-checking devices, etc., and to discussions of the scientific groundwork upon which treating technique is based. Under the latter head are included such matters as agencies of wood deterioration, including both fungi and insect life; the toxicity of preservatives; factors affecting penetration; and the determination of absorption and penetration. The chapter on preservatives covers all of the more common chemicals used for that purpose, as well as proprietary preparations. Another chapter discusses methods of protection that do not involve the use of preservatives. The chapter on economic aspects of preservative treatment necessarily gives preferred attention to crossties.

NEWS of the Month

Railroad Purchases Are Nation-Wide

In 1937 the railroads made purchases in 12,174 cities and towns in 2,637 of the 3,072 counties in the United States, according to a survey made by the Association of American Railroads. Launched last November, the survey, which was presented in the form of map exhibits to a special Senate committee investigating unemployment and relief by J. J. Pelley, president of the A.A.R., shows that there were only 435 counties in which no direct purchases by railroads appear to have been made.

I. C. Adopts Plan to Reduce Payrolls

A plan providing for the reduction of payroll expense by the elimination of positions and by vacations without pay has been placed in effect by the Illinois Central. Under the plan all employees, including officers, will contribute to the payroll reduction so that no one group will be called upon to bear the entire burden. In that group of employees which enjoys wage and working contracts through the Brotherhood, a ten per cent reduction in payroll is being accomplished through the elimination of positions. In the group of employees not covered by the contracts, including officers not under contract, each employee is to take ten days vacation without pay during April or May at such time as the employee chooses and the work of the department permits. The ten days may or may not be consecutive.

Public Favors Private Ownership

Seventy per cent of the persons replying to a questionnaire recently distributed by the American Institute of Public Opinion expressed themselves as being opposed to government ownership of the railroads. In other words, only 30 per cent of those filling out the questionnaire answered "yes" to the question "Do you believe the government should buy, own and operate the railroads?" To the question "Do you think the railroads would be run more efficiently if the government owned and operated them?" 64 per cent voted "no" and 36 per cent voted "yes". That the majority of persons do not consider government ownership of railroads imminent is revealed by the fact that 62 per cent replied in the negative to a question in which they were asked if they thought the government would be forced to take over the railroads eventually.

Railroad Net Declines in January

In January, the Class I railroads of the United States had a net railway operating income of only $6,919,879, which was at the annual rate of return of 0.49 per cent on their property investment, as compared with a net of $38,889,878, or 2.73 per cent in January, 1937, according to the Bureau of Railway Economics of the Association of American Railroads. Gross operating revenues for January totaled $279,258,713, as compared with $331,672,343 in the corresponding month of last year, a decrease of 15.8 per cent. Operating expenses amounted to $232,710,290, as compared with $253,621,533 in January of 1937, a decrease of 8.2 per cent. Taxes, however, increased from $28,052,582 in January, 1937, to $28,813,189 in the corresponding month of this year. The worst slump in railroad earnings in January appeared to have taken place among the lines in the Western district, where the railroads as a whole failed to earn sufficient revenue in January to meet their operating expenses and taxes.

I. C. C. Permits Small Rate Increases

On March 8 the Interstate Commerce Commission handed down a decision awarding the railroads increases in freight rates which are expected to average about 5.3 per cent and to yield about $175,000,000 a year on the basis of the traffic handled in 1936. This decision was the commission's answer to the railroads' plea for a 15 per cent increase in freight rates, which would have yielded additional revenues of $437,337,000 and which was needed to help offset increases in expenses of about $667,000,000 annually that have accrued to the carriers since 1933. In commenting on the commission's decision, J. J. Pelley, president of the Association of American Railroads, said that since the increase is only about one-third the amount asked by the railroads, it is inadequate to meet the situation but "it will be helpful to the railroads, as far as it goes." The decision allows a general increase in freight rates of 10 per cent on all commodities except products of agriculture, other than tropical fruits; animals and the products thereof; lumber, shingles and lath and articles taking lumber rates; and cottonseed oil and vegetable oils, on all of which groups of commodities an increase of five per cent is allowed. No increases were permitted in the rates on bituminous coal, lignite, coke and iron ore, but an increase of 10 cents a ton was allowed on anthracite coal.

F. D. R. Gets Facts on Railroad Situation

An announcement from President Roosevelt concerning proposals for the solution of the many problems which beset the railroads is expected early in April. In March the President held two meetings of his railroad conference and during the second of these meetings he appointed a committee "to give him * * * complete, definite and factual recommendations for immediate action by Congress in regard to the whole railroad situation which is critical." This committee was composed of W. M. W. Splawn, chairman of the Interstate Commerce Commission and Commissioners Joseph B. Eastman and Charles D. Mahaffie. Its report was submitted to the President on March 25.

Name Testing Laboratory After Prof. Talbot

On April 21 the Materials Testing Laboratory at the University of Illinois, Urbana, Ill., will become known as the Arthur Newell Talbot Laboratory in honor of Arthur N. Talbot, professor emeritus of the university, who is widely known in the railroad field for his investigations of various railroad engineering problems, particularly stresses in track. This new honor is being conferred on Prof. Talbot "for those brilliantly active years as a teacher and investigator which have contributed so much to the University of Illinois and to the engineering profession."

The naming of the laboratory will take place during a convocation ceremony on April 21. In the afternoon Robert E. Doherty, president of the Carnegie Institute of Technology, will make the principal address during ceremonies to be conducted in the university's auditorium. A banquet and reception to be held during the evening of the same day will bring the celebration to a close.

The University of Illinois is publishing a booklet entitled, "A Tribute to Arthur Newell Talbot," commemorating the renaming of the laboratory. A limited number of copies of this booklet will be available upon application to Prof. F. E. Richart, College of Engineering, Urbana, Ill.

Association News

Roadmasters Association

The Proceedings of the last annual convention have come from the press and are now being mailed to members. President W. O. Frame is contemplating a meeting of the Executive committee in the near future at which various committees will present tentative reports for review.

Bridge and Building Association

Approximately 25 members who were attending the convention of the American Railway Engineering Association in Chicago, gathered at luncheon on Tuesday, March 15. Following the luncheon, members of the Executive committee held a brief meeting at which several applications for membership in the association were acted upon. The Proceedings of the association are now coming from the printer and are being distributed to the members.

Maintenance of Way Club of Chicago

A symposium on frogs, switches and crossings was the feature of the March meeting and dinner, which was held on the twenty-eighth at the Auditorium Hotel with 94 persons in attendance. The design of these types of trackwork was discussed by L. I. Martin, sales engineer, Morden Frog & Crossing Works; their manufacture by A. F. Huber, chief engineer, Ramapo-Ajax Corporation; their installation by M. D. Carothers, division engineer, Alton, Bloomington, Ill.; and their maintenance by G. P. Palmer, engineer maintenance and construction, Baltimore & Ohio Chicago Terminal, Chicago. G. J. Slibeck, railroad sales and engineering, Pettibone-Mulliken Corporation, introduced the speakers and led the discussion.

At the next meeting, which will be held on April 25, A. N. Williams, president and general manager of the Belt Railway of Chicago and the Chicago & Western Indiana, will speak on "Track Conditions and Maintenance Work on Terminal Properties."

American Railway Engineering Association

At the Board of Direction meeting following the close of the convention in Chicago on March 17, it was announced that certain changes in the constitution of the association have been proposed and will be submitted to letter ballot of the members about April 1. These changes, which involve essentially a redraft of Articles 2 and 3 and an amendment to one clause of Article 4, are mainly for the purpose of clarifying the language relating to the requirements for admission to membership.

The committees on Outline of Work and on Personnel have practically completed the make-up of committees and the assignment of subjects, and it is expected that the booklet containing the committee assignments and personnel will be placed in the hands of members of the committees early in April. In completing the personnel of committees, A. E. Botts, assistant engineer maintenance of way, Chesapeake & Ohio, Richmond, Va., has been appointed chairman of the new Committee I, Roadway and Ballast, which is a consolidation of former Committee I, Roadway, and former Committee II, Ballast. Mr. Botts, succeeds Geo. S. Fanning, chief engineer, Erie, Cleveland, Ohio, as chairman of Committee I, H. M. Stout, assistant valuation engineer, Northern Pacific, St. Paul, Minn., has been appointed chairman of the new Committee XVI, Economics of Railway Location and Operation, which is a consolidation of former committees XVI and XXI, Economics of Railway Location and Economics of Railway Operation, respectively. Mr. Stout was chairman of former Committee XVI. M. F. Manion, formerly chairman of Committee XXI, has been appointed vice-chairman of the new Committee XVI.

Other changes announced in connection with committee personnel include the appointment of four new committee chairmen. H. M. Church, general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, succeeds H. Austill, chief engineer, Mobile & Ohio, St. Louis, Mo., as chairman of the Committee on Wood Bridges and Trestles; H. G. Morgan, signal engineer, Illinois Central, succeeds C. H. Tillett, signal engineer, Canadian National, Toronto, Ont., Canada, as chairman of the Committee on Signals and Interlocking; C. A. Knowles, valuation engineer, Chesapeake & Ohio, Richmond, succeeds C. C. Haire, engineer capital expenditures, Illinois Central, Chicago, as chairman of the Committee on Records and Accounts; and B. W. DeGeer, engineer water service, Great Northern, St. Paul, Minn., succeeds R. C. Bardwell, superintendent of water supply, Chesapeake & Ohio, Richmond, as chairman of the Committee on Water Service, Fire Protection and Sanitation. L. H. Laffoley, formerly chairman of the Committee on Shops and Locomotive Terminals, which committee has been abolished, has been appointed vice-chairman of the Committee on Buildings.

Two joint committees, representing the A.R.E.A. and the Mechanical division of the Association of American Railroads have been appointed to investigate two problems of common interest to the engineering and mechanical departments of the railways. One of these committees, which is headed by Dr. Arthur N. Talbot, professor emeritus, University of Illinois, will study the relation between track and rolling stock through a program of investigation and tests relating thereto, while the other committee will study the damage resulting from brine drippings from refrigerator cars, looking to the development of practices to overcome this damage.

The next convention will be held in Chicago on March 14-15-16, 1939.

Cribbing Fork—Additional information about the results of service-tests of the new cribbing fork developed by Ingersoll-Rand Company, New York, is given in Bulletin 2357, issued by that company.

Personal Mention

General

S. J. Hale, roadmaster on the Radford division of the Norfolk & Western, with headquarters at Roanoke, Va., has been promoted to assistant superintendent of the Shenandoah division, with the same headquarters.

A. T. Mercier, general manager of the Southern Pacific, Pacific Lines, with headquarters at San Francisco, Cal., and formerly a division engineer with this company, has been appointed vice-president of the company, with the same headquarters, and with such duties and responsibilities as may be assigned to him by the president. Mr. Mercier has been connected

A. T. Mercier

with the Southern Pacific and its subsidiaries, the San Diego & Arizona and the Pacific Electric, for 34 years. A native of New Orleans, La., he was born on December 11, 1881, and graduated from Rugby academy and Tulane University, completing a course in civil engineering at the latter school in 1903. He first entered railway service in January, 1904, as a transitman and clerk to a roadmaster on the Southern Pacific at Los Angeles. During the following 13 years he was advanced successively through the positions of assistant gang foreman, assistant engineer in charge of reconstruction work on the Colorado river, general foreman and engineer of bridges and buildings in charge of steel bridge construction, engineer and general foreman in charge of terminal construction at San Pedro, Cal., and Los Angeles, assistant division engineer of the Los Angeles division, assistant district engineer of the Southern district, and division engineer of the San Joaquin and the Los Angeles divisions. In February, 1917, he entered the operating department as assistant superintendent of the Shasta division at Dunsmuir, Cal., being promoted to superintendent of the Portland division at Portland, Ore., in September, 1918. Three years later he became general manager of the San Diego & Arizona, with headquarters at San

Diego, Cal., and in April, 1927, he was elected also vice-president of that road. On July 3, 1929, he was elected vice-president and general manager of the Pacific Electric and in the spring of 1933 he was made general manager of the Southern Pacific, Pacific Lines, which position he held until his recent appointment as vice-president.

P. J. Watson, Jr., president of the Kansas City Terminal, Kansas City, Mo., and an engineer by experience, has been elected president of the Terminal Railroad Association of St. Louis, Mo. Mr. Watson was born in Dunkirk, N. Y., in 1886 and

P. J. Watson, Jr.

entered railway service as a rodman on the Pennsylvania in February, 1903. Until June, 1908, Mr. Watson served in the engineering department of this company during summer vacations while completing his engineering education at Princeton. He then entered the service of the Missouri Pacific at St. Louis as a draftsman and later became an inspector on construction work. He returned to the Pennsylvania in January, 1909, as an assistant engineer, which position he held until June of the same year, when he entered the employ of the Wheeling & Lake Erie as an instrumentman. Later he became assistant engineer and in July, 1912, he entered the employ of the Alton as assistant engineer, subsequently being promoted to resident engineer in charge of the construction of new shops at Bloomington, Ill. In April, 1917, he entered the United States Army, and was commissioned captain, being later promoted to major in command of the First Battalion of the Twenty-Third Engineers. Mr. Watson was decorated with the Croix de Guerre and was honorably discharged in June, 1919, after 26 months service. He then re-entered railway service in the engineering department of the Alton, where he remained until December, 1919, when he became construction superintendent of the C. R. Cummins Company, Cleveland, Ohio. In August, 1921, he returned to railroad service as superintendent of the Kansas City Terminal. In January, 1930, he was promoted to general superintendent and in December, 1932, was elected president, which position he held until his recent election to the presidency of the Terminal Railroad Association of St. Louis.

John A. Schwab, division engineer of the Eastern division of the Pennsylvania, who has been promoted to superintendent of the Logansport division of that company, with headquarters at Logansport, Ind., as reported in the February issue, was born on July 26, 1903, at Menoken, N. D., and was graduated from the United States Military Academy at West Point, N. Y., in June, 1927. He entered railway service with the Pennsylvania on November 8, 1927, as a rodman in the construction department at Newark, N. J. A year later he was appointed assistant supervisor of track on the Williamsport division, with headquarters at Williamsport, Pa., later serving in the same capacity on the Philadelphia (Pa.) Terminal division and the Maryland division at Perryville, Md. After a month at the latter location he became supervisor of track on the Elmira division, with headquarters at Elmira, N. Y. In October, 1930, Mr. Schwab was transferred to the Williamsport division, and on April 18, 1932, he was appointed acting supervisor of track on the Maryland division at Wilmington, Del. He held this position until July of the same year, when he returned to Williamsport as supervisor of track. In December, 1932, he was assigned to special duty as supervisor of track at the general offices at Philadelphia, and then served in the same capacity on the Maryland division from March, 1933, to May, 1934. Mr. Schwab was then appointed assistant division engineer of the Middle division at Altoona, Pa., where he served until November, 1935, when he was made acting division engineer of the Eastern division at Pittsburgh, Pa. He was division engineer at that point from June, 1936, until the time of his recent promotion.

Engineering

R. H. Snyder has been appointed assistant engineer in the office of the chief engineer maintenance of way and structures of the Western lines of the Southern at Cincinnati, Ohio, to succeed **Adam Ritter,** who has retired. Mr. Ritter entered the service of the Southern in January, 1891, and since October, 1909, has been engaged in architectural work for the system.

P. W. Triplett, supervisor of track of the Chicago Terminal division of the Pennsylvania, with headquarters at Colehour, Ill., has been appointed assistant division engineer of the New York Zone, with headquarters at Jersey City, N. J., to succeed **J. S. Snyder,** who has been promoted to division engineer at Buffalo, N. Y.

J. D. Morris, supervisor of track on the Philadelphia Terminal division, has been appointed division engineer of the Monongahela division, with headquarters at Pittsburgh, Pa., to succeed **T. E. Nestor,** who died on January 31.

F. J. Jerome, division engineer on the New York Central, with headquarters at Chicago, effective April 1 has been promoted to the newly-created position of engineer maintenance of way of the Michigan Central (a unit of the New York Central System), with headquarters at Detroit, Mich. **E. H. McGovern,** division engineer on the Cleveland, Cincinnati, Chicago & St. Louis (also a unit of the New York Central System), with headquarters at Mattoon, Ill., has been transferred to Chicago to succeed Mr. Jerome.

Thomas P. Warren, who has been appointed division engineer of the Chicago division of the Chicago, Rock Island & Pacific, with headquarters at Chicago, as reported in the March issue, has been identified with this company for nearly 28 years. He was born on March 24, 1887, at Covington, Ky., and was educated at the University of Kentucky, where he graduated in civil engineering in 1910. He entered railway service with the Rock Island on August 8, 1910, as a draftsman in the district office at Cedar Rapids, Iowa. From 1911 through 1912 he served as a rodman and instrumentman at various points, then being appointed an assistant engineer, in which capacity he served at Des Moines, Iowa, and Fairbury, Neb. In 1919, Mr. Warren was promoted to office engineer in the district office at Des Moines, where he remained until 1924, when he was made a resident

Thomas P. Warren

engineer at Eldon, Iowa. From 1929 through 1930, he served as division engineer, first at Chicago and then at Fairbury, then being assigned to the position of office engineer at Kansas City, Mo. In 1933, Mr. Warren was appointed roadmaster and served in this capacity at Des Moines and Atlantic, Iowa, being located at the later point at the time of his recent appointment as division engineer with headquarters at Chicago.

William Michel, chief engineer of the engineering advisory committee on way and structures of the Chesapeake & Ohio, the Erie, the New York, Chicago & St. Louis and the Pere Marquette (Van Sweringen lines), with headquarters at Cleveland, Ohio, has retired, effective April 1. Effective with Mr. Michel's retirement, the position has been abolished and the duties assumed by the chief engineers of the respective lines.

Mr. Michel was born on March 18, 1866, at Columbus, Ohio, and entered railway service in 1885 with the Columbus, Hocking Valley & Toledo (now part of the C. & O.), serving as a rodman and chainman and a leveler on location until 1886.

In that year Mr. Michel went with the Louisville, Cincinnati & Dayton (now part of the Baltimore & Ohio), serving as a transitman and assistant engineer until 1887, when he returned to the Columbus, Hocking Valley & Toledo as an assistant engineer. In 1899, he was promoted to assistant chief engineer and mining engineer of this company and after three years he was made engineer maintenance of way, continuing in the later capacity when this company became known as the Hocking Valley. On November 8, 1910, Mr. Michel was appointed chief engineer of the Hocking Valley, which position he retained until 1930, when the Hocking Valley was absorbed by the C. & O. At that time he was appointed chief engineer of the engineering advisory committee of the so-called Van Sweringen lines, which position he continued to hold until his retirement.

Track

F. J. Kovaleski, a yard foreman on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to roadmaster, with headquarters at Madison, S. D., to succeed **T. A. Ealy,** who has retired.

V. I. Kessinger has been appointed roadmaster on the Southern Kansas division of the Atchison, Topeka & Santa Fe, with headquarters at Independence, Kan., succeeding **E. L. Banion,** who has been transferred to Marceline, Mo., to replace **A. L. Kleine,** who has retired.

J. W. Newkirk, assistant roadmaster on the Radford division of the Norfolk & Western, has been promoted to roadmaster, with headquarters as before at Roanoke, Va., succeeding **S. J. Hale,** who has been advanced to assistant superintendent of the Shenandoah division, with the same headquarters.

M. L. Bradbury, assistant roadmaster on the Galena division of the Chicago & North Western, with headquarters at Sterling, Ill., has been promoted to roadmaster of Sub-division No. 1 of the Southern Illinois division, with headquarters at South Pekin, Ill., relieving **T. C. Moe,** who has retired effective April 1, after a record of 46 years service with the Chicago & North Western.

L. W. Green, assistant supervisor of track on the Middle division of the Pennsylvania, has been promoted to supervisor of track on the Buffalo division, with headquarters at Buffalo, N.Y., to succeed **F. S. Bowden,** who has been transferred to the Pennsylvania-Reading Seashore Lines, with headquarters at Camden, N.J. He succeeds **T. E. Boyle,** who has been transferred to the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philadelphia, Pa., to replace **J. D. Morris,** who has been promoted to division engineer as noted elsewhere in these columns.

J. M. Collins, assistant supervisor of track on the Fort Wayne division of the Pennsylvania, with headquarters at Fort Wayne, Ind., has been promoted to supervisor of track on the Grand Rapids division, with headquarters at Petoskey, Mich., succeeding **A. W. Miller,** who has been transferred to the Cincinnati division, with headquarters at Xenia, Ohio, to replace **H. W. Manning,** who has been appointed supervisor of the Chicago Terminal division, with headquarters at Colehour, Ill. Mr. Manning relieves P. W. Triplett, whose promotion to assistant division engineer of the New York Zone at Jersey City, N.J., is announced elsewhere in these columns.

Lynn W. Jones, whose promotion to roadmaster on the Chicago, Burlington & Quincy at Curtis, Neb., was reported in the March issue, was born in Otis, Colo., on July 29, 1890. After attending Colorado State Teachers college, he began railway service on July 15, 1909, as a section laborer with the Burlington, and in October of the same year he became a section foreman. Mr. Jones was advanced to roadmaster at Alliance, Neb., on October 16, 1925, and on June 1, 1931, he was sent to Edgemont, S. D., as track supervisor. On September 1 of the same year he was transferred to Brush, Colo., where he was located at the time of his recent promotion to roadmaster with headquarters at Curtis.

Earl R. Word, whose promotion to supervisor of track on the Illinois Central at Council Bluffs, Iowa, was reported in the March issue, is a native of Oxford, Miss., where he was born on January 20, 1894. He received his Bachelor of Science degree from the University of Mississippi in 1915, and in October of that year he started work with the Illinois Central as a chainman at Fort Dodge, Iowa, advancing through the positions of rodman, draftsman and instrumentman. In 1924 he was loaned to the New York, Chicago & St. Louis, where he served as a field engineer on the relocation of the Toledo & Southwestern, returning to the I. C. in 1925 as an assistant engineer. During 1926 and 1927 Mr. Word had charge of the construction of the Mississippi & Skuna Valley, a logging railroad, and following the completion of this line he continued to serve the I. C. as an assistant engineer until his recent appointment to the position of supervisor of track.

Norris W. Baxter, whose promotion to roadmaster on the Chicago, Rock Island & Pacific at Peoria, Ill., was noted in the March issue, was born in Green County, Tenn., On September 21, 1890. In June, 1908, he entered railway service with the Rock Island as a section laborer on the Nebraska-Colorado division. He was advanced to assistant extra gang foreman on September 1, 1911, and became a section foreman on December 1, 1912. During the working seasons of 1927, 1928, 1929, and 1930 Mr. Baxter was in charge of surfacing and rail relaying gangs. After the latter year he served as section foreman and yard foreman until March 1, 1936, when he was promoted to track supervisor. In April, 1937, Mr. Baxter was made assistant roadmaster in charge of the system's rail relaying gang, and in this position he supervised rail laying on the First, Second, and Third districts. From this position he was appointed roadmaster with headquarters at Peoria.

Bridge and Building

R. DeJaiffe, assistant supervisor of bridges and buildings of the Philadelphia division of the Pennsylvania, has been appointed assistant master carpenter of the Philadelphia Terminal division, with headquarters at Philadelphia, Pa. **J. F. Twomey,** inspector maintenance of way of the Philadelphia Terminal division, has been promoted to assistant master carpenter of the Philadelphia division, with headquarters at Harrisburg, Pa.

J. D. Voorheis, bridge and building foreman on the Wabash at Detroit, Mich., and formerly supervisor of bridges and buildings on this road, has retired after almost 46 years of service with that company. Born at Belleville, Mich., on May 27, 1867, Mr. Voorheis began his railway career with the Wabash on May 16, 1892, as a bridge and building carpenter at Peru, Ind. He became a bridge and building foreman on the Detroit division on August 1, 1901, serving there until November, 1922, when he was promoted to supervisor of bridges and buildings at Springfield, Ill. He was transferred to Peru in June, 1924, and to Montpelier, Ohio, in May, 1931, returning to Detroit as a bridge and building foreman in January, 1932, where he was located until his retirement on February 28.

N. E. Peterson, roadmaster of the Chicago & Illinois Midland, with headquarters at Springfield, Ill., has been appointed supervisor of track and structures, in which position, in addition to his former duties as roadmaster, he will also assume the responsibilities of superintendent of bridges and buildings, succeeding **Cecil L. Metzmaker,** whose death on March 3 is reported elsewhere in these columns.

Mr. Peterson was educated at the University of Minnesota, graduating in civil engineering in 1922. He entered railway service on January 13, 1923, as a chairman on the construction of a yard at Central City, Ky., for the Illinois Central. On July 15 of the same year he was made a rodman at the same point, and in 1924, he was further promoted to masonry inspector in the bridge department. In 1925, Mr. Peterson became an instrumentman, in which capacity he served at Edgewood, Ill., and Metropolis. Two years later he left the Illinois Central to enter the service of the Chicago & Illinois Midland as an instrumentman. In June, 1935, he was promoted to roadmaster, which position he held until his recent appointment as supervisor, track and structures.

D. C. D. Todd, who has been promoted to master carpenter on the Fort Wayne division of the Pennsylvania, as reported in the March issue, was born at Wilmington, Del., on January 30, 1898. He studied civil engineering at the University of Delaware, and upon his graduation in June, 1918, became a rodman on the Delaware division of the Pennsylvania at Wilmington, Del. In August, 1922, he was transferred to the engineering corps of the Atlantic division, with headquarters at Camden, N. J., and two years later he was made acting assistant supervisor of track on that division, at Wildwood, N. J.

In December, 1925, he was appointed assistant supervisor of track at Hollidaysburg, Pa., and in April, 1927, he was transferred to the chief engineer's office at Philadelphia, Pa., as engineer and designer on the Philadelphia terminal improvements. He was made maintenance of way inspector on the Philadelphia Terminal division, in February, 1935, and was promoted to assistant supervisor of bridges and buildings in August, 1936, holding the later position until his recent promotion to master carpenter.

Obituary

George C. Briggs, building engineer of the Canadian National, with headquarters at Winnipeg, Man., died suddenly at his home in that city on March 16.

J. W. Marks, track supervisor on the Western lines of the Southern with headquarters at Chattanooga, Tenn., died suddenly on February 20. He had been in the service of that company since March, 1914.

Cecil L. Metzmaker, superintendent of bridges and buildings of the Chicago & Illinois Midland, with headquarters at Springfield, Ill., was killed at Kincaid, Ill., on March 3 when a derrick cable broke, causing the boom to fall on his his head.

Ralph A. Feldes, assistant to the vice-president of the Indiana Harbor Belt, with headquarters at Chicago, and formerly chief engineer of this company, died in that city on March 11, after an illness of two weeks. He was born at LaSalle, Ill., on August 19, 1883, and entered the employ of the New York Central System on March 1, 1905, in the engineering department of the Chicago, Indiana & Southern. He advanced through various positions in the engineering department and on July 25, 1917, entered the army where he gained the rank of lieutenant-colonel of engineers in France. After the war he returned to railway service as assistant chief engineer of the Indiana Harbor Belt, which position he held until 1922, when he was promoted to chief engineer. On November 16, 1928, he was further advanced to assistant to the vice-president, which position he was holding at the time of his death.

Thomas P. Soule, general supervisor of bridges and buildings on the New York Central, Lines Buffalo and East, with headquarters at New York, died of pneumonia on March 12 in the Dobbs Ferry hospital, Dobbs Ferry, N. Y., at the age of 61. Mr. Soule was born on December 14, 1876, at Albion, N. Y., and first entered railway service on May 1, 1904, as a carpenter on the Rome, Watertown & Odgensburg (now part of the New York Central). On May 1, 1907, Mr. Soule was advanced to carpenter foreman, and on June 1, 1918, he became a pile driver foreman. Early in the following year he was further promoted to assistant supervisor of bridges and buildings, with headquarters at Watertown, N. Y. On October 1, 1922, he was transferred to Syracuse, N. Y., and on December 1, 1926, he was promoted to supervisor of bridges and buildings on the Adirondack division, with headquarters at Malone, N. Y. Three years later Mr. Soule was transferred to the Mohawk division, with headquarters at Albany, N. Y., and on April 1, 1934, he was further promoted to general supervisor of bridges and buildings, with headquarters at New York, which position he held until his death. Mr. Soule had been active in the affairs of the American Railway Bridge & Building Association and served as a director of this association from 1935 until the time of his death.

Charles H. Johnson, assistant chief engineer of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., died on March 9 after a four-weeks illness. With the exception of slightly more than a year, Mr. Johnson had been continuously with the N. C. & St. L. since 1900. He was born in Nashville on August 30, 1877, and was educated at Montgomery Bell academy and at Vanderbilt university. He worked for a time as a rodman and instrumentman on a War Department project involving improvement of the Cumberland river, before entering railway service with the N. C. & St. L. as a rodman on construction work. After serving successively as transitman, resident engineer and chief of party, he was made engineer of construction in August, 1903, in charge of double-track work. In March, 1916, he left the railroad to become field superintendent for a contractor on the construction of a dam on the Caney Fork river, as part of a hydro-electric development. He returned to the N. C. & St. L. in October, 1917, as acting division engineer, and was promoted to engineer of construction on June 1, 1919. His title was changed to senior assistant engineer chief engineer, with headquarters at Nashville, on November 1, 1931.

Charles H. Johnson

George P. Stowitts, formerly engineer of design and engineer of construction of the Cincinnati Union Terminal, and more recently engineer for the New York region of the Public Works Administration, died of a heart attack on March 5 at Montclair, N. J., shortly after alighting from a train. A native of Westfield, N. Y., Mr. Stowitts was born on March 19, 1879, and was educated at Rensselaer Polytechnic Institute. In 1900, he entered railway service with the New York Central, and after serving in various positions in the engineering and maintenance departments he was appointed design engineer of the Lines East of Buffalo. After eight years in this capacity Mr. Stowitts was appointed district engineer, and in 1920 he left railroad service to become chief engineer of the Lord Dry Docks Company at West New York, N. J. From 1922 to 1925, he was engaged in consulting practice at New York, then joining the Seaboard Air Line as engineer in charge of the construction of a new line. In 1927, Mr. Stowitts became engineer of design of the Cincinnati Union Terminal and later he served as engineer of construction for this terminal. Following the completion of this project, Mr. Stowitts returned to private consulting practice at Cincinnati, but after a short time he entered the service of the Public Works Administration at Des Moines, Iowa, later becoming engineer for the New York region, where he was located at the time of his death.

George H. Brown, who retired on May 1, 1931, as assistant chief engineer maintenance of way on the Eastern region of the Pennsylvania, died at his home in Haverford, Pa., on March 7. Mr. Brown was born at Renovo, Pa., on December 21, 1867, and was educated at Rensselaer Polytechnic Institute and at Princeton University, graduating with the degree of C. E. He entered the service of the Pennsylvania as a rodman on June 15, 1885, and in the following year was advanced to transitman. On May 15, 1888, he was appointed assistant engineer in charge of bridges and changes of line on the Middle division, remaining in that capacity until the following January, when he was transferred to the maintenance of way department, serving as assistant supervisor of track successively on the Middle, the Pittsburgh, the Philadelphia (Pa.) Terminal, and the New York divisions. Mr. Brown was appointed supervisor of track in 1894, serving in this capacity on the Frederick and the Maryland divisions until March, 1901, when he was promoted to division engineer, holding this position first on the Eastern division, and later on the Middle and the Philadelphia divisions. On November 8, 1917, he was made acting principal assistant engineer of the Eastern Pennsylvania division. During the period of Federal control, he was assistant engineer maintenance of way of the Pennsylvania's Eastern lines, and on March 1, 1920, upon the termination of Federal Control, he was appointed assistant chief engineer maintenance of way of the Eastern region, holding this position until his retirement from active duty in 1931.

Col. Frederic A. Molitor, consulting engineer in the railroad field and for many years actively engaged in railway construction and improvement with a large number of roads, died at his home in Stamford, Conn., on March 12. He was 69 years old. Born in Detroit, Mich., April 21, 1868, Mr. Molitor was educated at Trinity school in New York and at Cornell university. He first entered rail-

way service with the Central Railroad of New Jersey in 1886, serving successively as instrumentman, draftsman and chief draftsman. For brief periods during the next few years he worked as an assistant engineer on the Baltimore & Ohio on the construction of the Kill van Kull bridge on the New York extension, as principal assistant engineer of the Kentucky Central (now a part of the Louisville & Nashville), and as engineer maintenance of way of the Western division of the Chesapeake & Ohio. From January to October, 1891, he was general roadmaster of the Louisville Southern (now part of the Southern). He then became engineer of the Philadelphia Belt line, and in September, 1894, he went with the Long Island as engineer in charge of construction of the Montauk division. In December, 1895, Mr. Molitor became chief engineer of the Choctaw, Oklahoma & Gulf and allied companies (now part of the Chicago, Rock Island & Pacific), leaving that position to become general manager and chief engineer of the Midland Valley. In 1905 he became connected with the government of the Philippine Islands as supervisor of the railways there; he subsequently spent a year during 1907-8 studying railroad conditions and terminal problems in the Orient and in Europe before returning to New York to open an office as a consulting engineer.

Victor K. Hendricks, formerly federal chief engineer of the St. Louis-San Francisco and the Missouri-Kansas-Texas, died on March 19 at his home at Oak Park (Chicago), Ill., of pneumonia. Mr. Hendricks was born on May 28, 1869, and was a graduate of Rose Polytechnic Institute. He entered railway service in 1890 as a rodman on the Fairhaven & Southern, and during the following 13 years he served in engineering capacities with this company, the Bellingham Bay & Eastern (now part of the Northern Pacific), the Terre Haute & Indianapolis (now part of the Pennsylvania), and the Terre Haute & Logansport (now also part of the Pennsylvania). At the end of this period he entered the service of the Baltimore & Ohio as assistant to the engineer maintenance of way, later becoming division engineer on this road at Baltimore, Md. On January 1, 1907, he entered the service of the Frisco as assistant engineer maintenance of way, later serving as office engineer and principal assistant engineer in charge of timber preservation, holding the latter position also with the Chicago & Eastern Illinois. On March 1, 1913, Mr. Hendricks was promoted to assistant chief engineer of the Frisco and in July, 1918, he was made federal chief engineer of this company and of the Missouri-Kansas-Texas. On February 1, 1919, he became assistant chief engineer of both these companies but shortly relinquished his connection with the Katy. From March 15, 1920, to March 1, 1921, Mr. Hendricks served successively as field engineer and regional engineer with the Southwestern region of the United States Railroad administration. At the end of this period he moved to Chicago where he engaged in engineering work with various companies and organizations until his death.

Supply Trade News

Personal

Frank J. Carr has been appointed assistant to the president of the **American Steel & Wire Co.,** Cleveland, Ohio, a subsidiary of the **United States Steel Corporation.** Mr. Carr, for the past four years, has been comptroller of the Tennessee Valley Authority, at Knoxville, Tenn.

Maurice Alvin Long, president of the M. A. Long Company, Baltimore, Md., and former assistant to chief engineer of the Baltimore & Ohio, died on February 27, at his home in Baltimore, at the age of 63 years. Mr. Long was born in Middletown, Ohio, on October 25, 1875. He studied architecture, engineering and railroad engineering in the Scranton, Pa., schools. In 1899 he went with the Baltimore & Ohio, serving as architect and assistant on engineering corps. In 1904 he was appointed architect and in February, 1913, was appointed assistant to chief engineer on the Baltimore & Ohio system. Mr. Long later organized the engineering contracting firm of M. A. Long Company, of which he was president at the time of his death.

Trade Publications

Preventing Fires—The Linde Air Products Company, New York, has issued a 16-page, illustrated booklet which discusses the various precautions that may be taken to prevent welding and cutting fires.

Electrode Quantities—Tables designed to facilitate the computation of electrode requirements for various types of welds are given in an eight-page pamphlet recently issued by the General Electric Company, Schenectady, N. Y.

Crawler Tractors—The model "SO" controlled-ignition oil tractor manufactured by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., is the subject of a 36-page illustrated booklet recently issued by this company. Each principal part of the tractor is taken up separately and described in detail and a page of specifications is included.

Lifting Jacks—The Duff-Norton Manufacturing Company, Pittsburgh, Pa., has issued a highly attractive and informative catalog of 40 pages, describing and illustrating its complete line of lifting jacks, including the various types adapted particularly for use in the track and bridge and building departments. Reference is also included with regard to the various types and sizes of trench braces manufactured by the company.

U.S.S. Copper Steel—This is the title of a 16-page pocket-size booklet which has recently been issued by certain subsidiaries of the United States Steel Corporation. The booklet contains pertinent information on copper steel, lists the various uses to which this alloy is adapted and gives the results of tests conducted by the American Society for Testing Materials, together with the remarks of a number of users of copper steel.

Roadbed Drainage—"Roadbed Stabilization by Drainage" is the title of a treatise written by H. E. Cotton, drainage engineer of the Armco Culvert Manufacturers Association, and published in a booklet recently issued by this organization. The booklet also contains instructions for using the soil auger, and contains an article by H. H. Houk, chief engineer, Alabama State Highway Department, on "Subgrades vs. Pavement Failures."

Manganal—The Stulz-Sickles Company, Newark, N. J., has issued a 16-page catalog, dealing comprehensively with its line of nickel-manganese (Manganal) products, including bare and coated welding rods, applicator or filler bars, and forged wedges and wedge bars, for reclaiming or repairing trackwork, equipment or machine parts of 11 to 14 per cent manganese content. The catalog not only describes the various products, but also includes many illustrations of their uses in a wide variety of reclamation work. Reference is also made to Seaco, the special hard-surfacing electrode developed by the company for application over Manganal where a surface hardness of 550 to 600 Brinell is desired.

Aluminum Paint Manual.—A comprehensive treatise on the application and use of aluminum paint, which contains 102 pages, has been published by the Aluminum Company of America, Pittsburgh, Pa. The manual is designed to serve as a guide for the selection of a proper aluminum paint for any particular service and offers directions for the most efficient methods of mixing and applying the paint. In separate chapters the handbook discusses the characteristics of aluminum paint, pigments, vehicles, results of tests, methods of application, general interior painting, and specifications for aluminum paint vehicles. It also gives directions for the use of aluminum paint on various types of surfaces and includes recommendations for handling and storing aluminum paint paste and powder.

Design of Welded Piping—This is the title of a 200-page illustrated handbook, which is being distributed by the Oxweld Railroad Service Company, Chicago. The purpose of the book, which replaces Design Standards for Oxwelded Steel and Wrought Iron Piping, first published in 1929, is to supply essential information on all design phases of welded piping. The material is presented in six parts as follows: (1) Engineering Aspects of Welded Piping; (2) Joint Design for Steel and Wrought Iron Piping; (3) Cast Iron, Galvanized Iron, Stainless Steel and Non-Ferrous Piping; (4) Piping Layout and Drawings; (5) Specifications for Welded Piping; and (6) Appendix. Noteworthy among the contents of the latter are tables giving dimensions of wrought iron and wrought steel pipe; data, including drawings and tables, on welded fittings; and extracts dealing with the welding of pipe joints from the American Tentative Standard Code for pressure piping.

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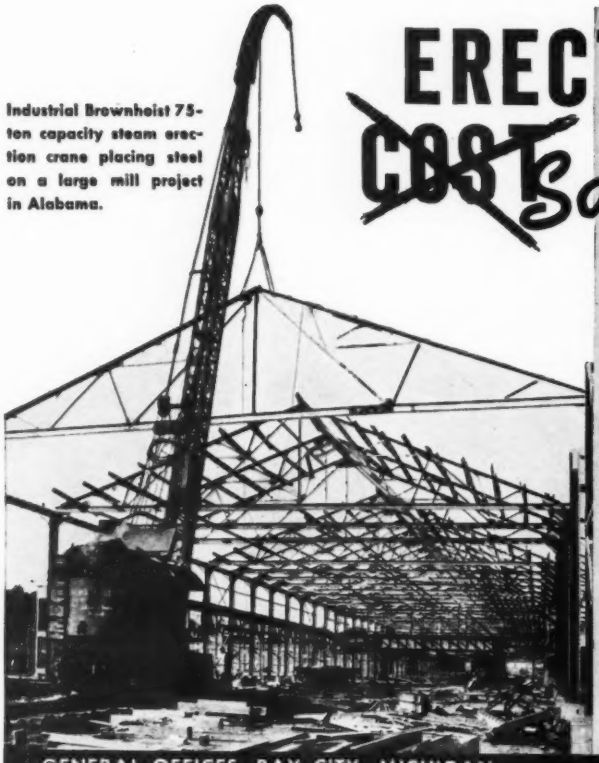

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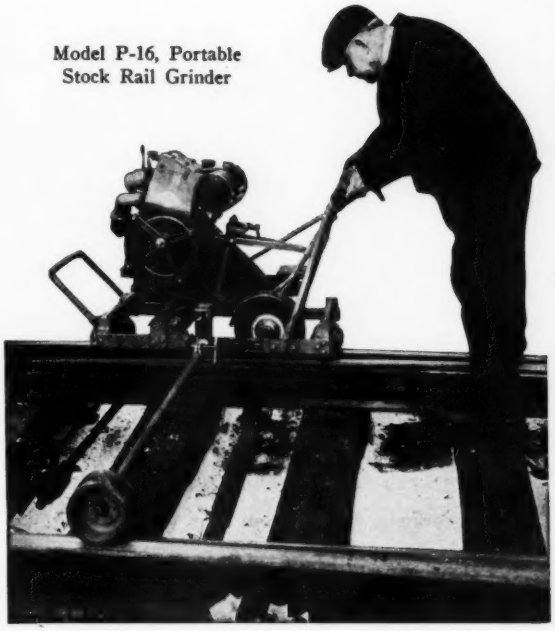

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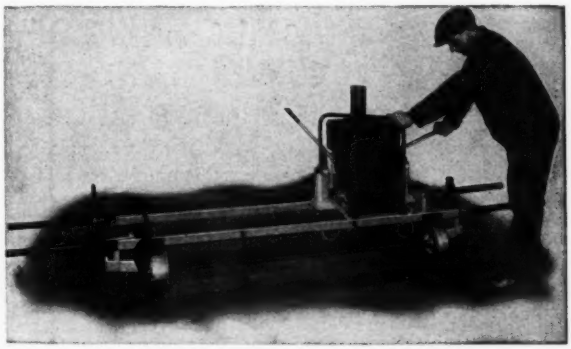

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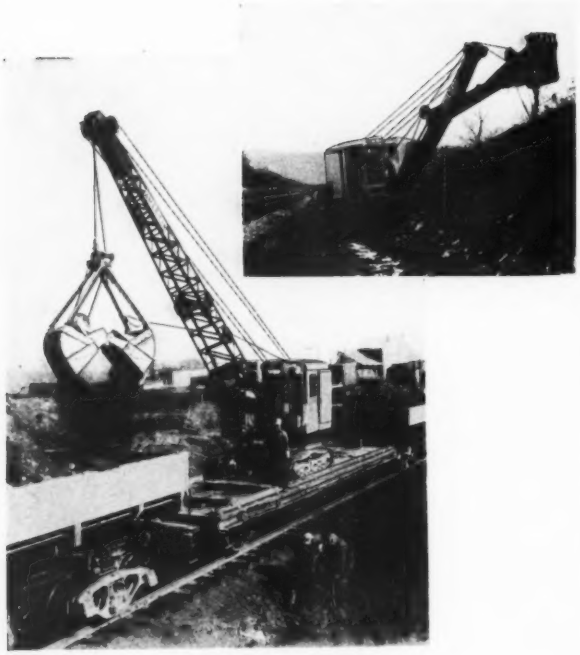

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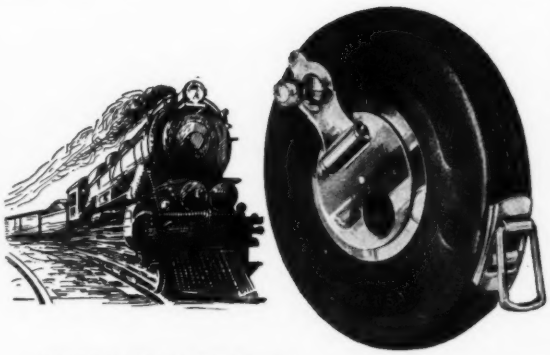

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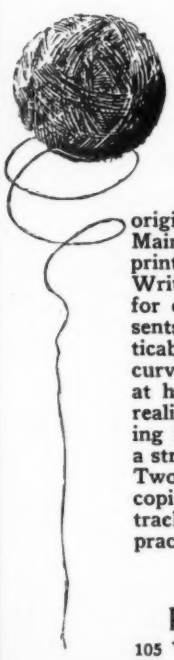

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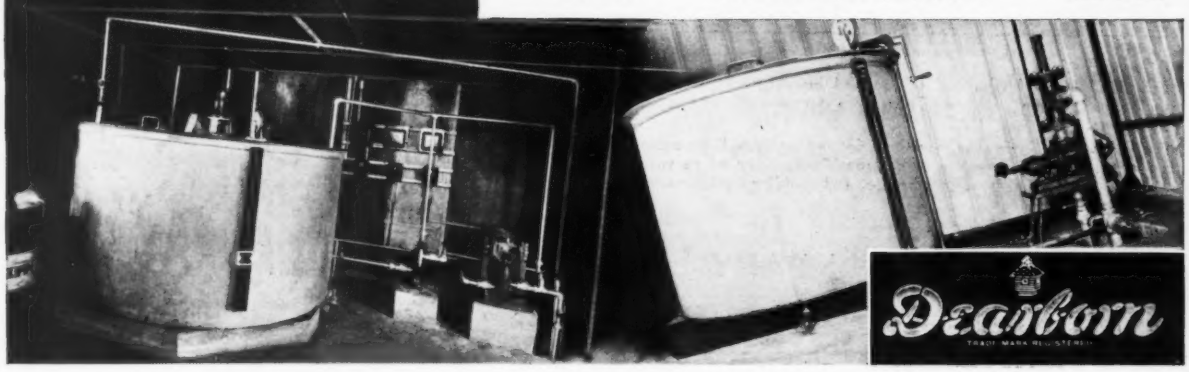

ALPHABETICAL INDEX TO ADVERTISERS

Air Reduction Sales Company....233
American Hoist & Derrick Co....280
Armco Culvert Mfrs. Assn....235
Barco Manufacturing Co....237
Bethlehem Steel Company....230
Dearborn Chemical Company....282
Eaton Manufacturing Company....228
Fairmont Railway Motors, Inc....231
Industrial Brownhoist....278
Ingot Iron Railway Products Co....235
International Harvester Company....234
Koppers' Company....232
Lufkin Rule Co., The....280
Maintenance Equipment Co....278
Mall Tool Company....281
Metal & Thermit Corporation....239
National Lock Washer Company, The....227
Nordberg Mfg. Co....277
Oxweld Railroad Service Company, The....242
P. & M. Co., The....284
Pettibone Mulliken Corporation....283
Railroad Accessories Corporation....229
Railway Track-work Co....279
Reliance Spring Washer Division....228
Republic Steel Corporation....240
Simmons-Boardman Publishing Corp....236-280
Syntron Co....281
Tar and Chemical Division of Koppers Co....232
Templeton, Kenly & Co....281
Truscon Steel Company....240
Union Carbide and Carbon Corporation....242
Warren Tool Corporation....279

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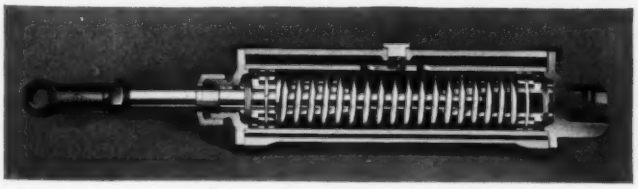

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